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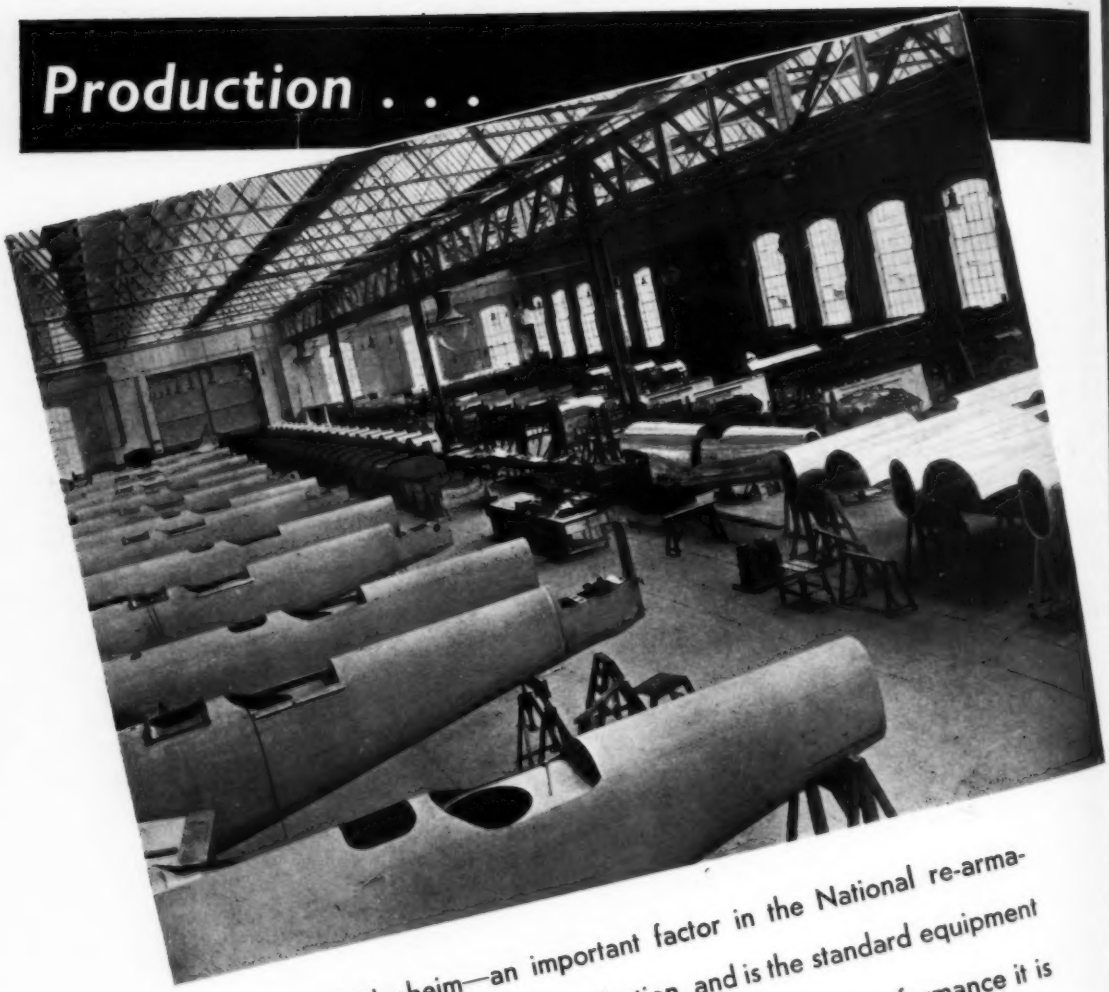

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The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor C. M. POULSEN

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Chief Photographer JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (50 lines).

HERTFORD ST., COVENTRY. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.

GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2. Telegrams: Autopress, Birmingham. Telephone: Midland 2971.

260, DEANSGATE, MANCHESTER, 3. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.

26B, RENFIELD ST., GLASGOW, C.2. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Canada: Year, £1 13 0. 6 months, 16s. 6d. 3 months, 8s. 6d. Other Countries: Year, £1 16 0. 6 months, 18s. 0d. 3 months, 9s. 0d.

No. 1522. Vol. XXXIII. FEBRUARY 24, 1938. Thursdays, Price 6d.

The Outlook

Future of Civil Aviation

LIKE a certain French aeroplane which was on its way to one of the Olympia aero shows several days after the opening, the Cadman Report on Civil Aviation is "incessantly expected." One may be quite sure that it will not be issued until the Cabinet has had time to make up its mind about acting upon the report, and *l'affaire Eden* may cause a certain amount of delay.

In the meantime, rumour is busy with the report, and a surprising number of people know "from a well-informed source" that such-and-such recommendations are made in the report. Some of these rumours are so fantastic that one may quite safely dismiss them. Others, however, sound likely enough and are probably, if not entirely accurate, at least substantially so.

One of the most persistent of these rumours is to the effect that Imperial Airways are to be "pushed out of Europe," meaning that the report will recommend that the company must become, in fact as well as in name, solely Imperial. There is much to be said for such a course. The Empire air routes are by far the most important sphere of British civil aviation activities, and the running of them may well be regarded as a "whole-time job."

Among other advantages which would arise would be the inclusion of the London-Paris route in the de-monopolised area which is at present defined by a line from London to Berlin. During the early days of so-called commercial aviation the London-Paris route was, quite rightly, regarded as a trial ground, and the first faltering steps of the young infant were made sufficiently close to home to make supervision possible. Conditions have changed and the same arguments no longer apply. Imperials would probably regret the loss of the London-Paris route, which at present gives them that close contact with the French Government which is so valuable when questions involving a *quid pro quo* arise, but we cannot hope to make omelettes without breaking eggs.

Another rumour has it that an Under-Secretary of State for Air is to be appointed to look after civil aviation. The principle of having two Under-Secretaries, one for civil and one for Service aviation, is sound enough, but much more depends upon the man than upon the post. A strong man in the wrong place will get things done in spite of obstacles, whereas a weak man in the right place will still be a weak man and will produce feeble results.

F.A.A. Short-service Commissions

SHORT-SERVICE commissions have hitherto been a speciality of the R.A.F., and it is surprising to see the Navy following suit in the case of the Fleet Air Arm. The new scheme is outlined on page 183.

When the present long-drawn-out discussions between the Air Ministry and the Admiralty have been brought to a close, and it has been decided which stations are to be handed over to the Admiralty for the training of naval pilots and the accommodation of F.A.A. units when on shore, the R.A.F. pilots will disappear from the aircraft carriers. They are only 30 per cent. of the whole number, but still they will have to be replaced by naval personnel. It is expected, when the dual control has gone and naval pilots no longer have to accept temporary commissions in the R.A.F., that more executive officers of the Royal Navy and Royal Marines will come forward and volunteer to be trained as pilots. The drawbacks attendant on the dual control are believed to have checked this volunteering in recent years. So regular officers ought to provide one source of additional pilots.

In addition to that, it is well known that the Admiralty is preparing a scheme for training ratings as pilots, on the lines of airman pilots in the R.A.F. Hitherto the Air Ministry has prevented the Admiralty from doing this, and, though only a few airman pilots have been employed on carriers, those few cases were enough to make the petty-officers ask "Why not we too?" Their grievance will now be removed, and ratings should produce a considerable number of pilots. Even so, the total is not expected to come up to future requirements.

Increasing Air Arm

AT present the Rear Admiral (Carriers) has five ships in his command, *Courageous, Glorious, Furious, Eagle,* and *Hermes*. The *Argus* is now a mother ship for Queen Bees. These five will accommodate about 170 aircraft. But five new and larger carriers have been ordered, of which *Ark Royal* has been launched, and *Indomitable* is being built. It is believed that these new carriers between them will hold 350 aircraft. In addition, capital ships and cruisers are having catapults installed as fast as is possible, and some of them will carry four aircraft each. The Admiralty has to provide pilots for a much larger

Flight photograph.

BATTLE ARRAY: This flight of Fairey Battles has that grimly purposeful air which always seems to distinguish the modern medium bomber dressed in camouflage. In large-scale production, and now forming the equipment of several R.A.F. squadrons, the Battle has the Rolls-Royce Merlin II engine. Top speed is 257 m.p.h. at 15,000ft.

air arm than has ever existed before. It is taking time by the forelock in inviting applications for short-service commissions in April next.

It will be noted that of the seven years for which the S.S. officers originally engage, two are to be spent on training. The Air Force, in the stress of expansion, is now allowing an average of only ten months. A naval pilot, however, has to learn more than is necessary for many classes of R.A.F. pilot. He has to learn to land on a deck, and if he goes on to catapult seaplanes, as many of them do, he must be able to alight on the sea beside his ship and manage his seaplane while afloat. Certain other nautical knowledge has to be acquired, for though the S.S. officer will never command a warship, he must still be a seaman as well as an airman.

It will therefore be at least two years before the Fleet Air Arm gets any active help from this new scheme. In the meantime it must rely on an increased intake of executive officers and on the new supply of rating pilots to compensate for the loss of the 30 per cent. of R.A.F. pilots. These new men, of course, will also have to be taught to fly, but they need not necessarily spend two years over their training.

Prospects of the S.S. Officers

GENERALLY speaking, it is rather hard to understand why so many young men are willing to enter the R.A.F. for four years, knowing that at the end of the time most of them will have to start looking for jobs in civil life. Very largely the cause must be the intense desire of the youth of to-day to learn to fly at no cost to himself. This enthusiasm for the air evidently dulls the view of the future. Perhaps, after all, it is understandable, British youth being what it is, and for that the country may be thankful.

As against the six years' employment offered by the R.A.F. before expansion began, and the four years now offered, the Admiralty asks for an engagement for seven years. In some cases the officer will then be 30 years of age. The regulations provide that service on the active list may be extended to fifteen years, and in certain cases for a further period so as to qualify for retired pay. It seems probable that this extension up to fifteen years will be granted to a good many, at least of the first intake. A man who has done seven years of naval flying will be a valuable man, and there is every appearance that seven years hence the Navy will have great need of men who are not only experienced pilots, but are also full of general naval knowledge. With a good chance of fifteen years' active employment and a further chance of qualifying for retired pay, the prospects of a short-service officer in the Navy do not seem too depressing. There is, of course, an Officers' Civil Employment Committee at the Admiralty, which will do its best to help those who leave after seven years to find work in civil life.

Another reason why the S.S. officers are likely to be offered an extension after their seven years' service, is that the Navy does not feel the same need as the R.A.F. to build up a large reserve of pilots. If a carrier were to be sunk by wreck or in action, there would be no need

to call on reserves of pilots until another carrier were ready to accommodate them.

It remains to be seen whether, at the end of the next fifteen years, the supply of pilots from regular officer and rating sources will be sufficient to meet all the requirements of the Fleet Air Arm, or whether short-service pilots will become a standing necessity. In the immediate future there is bound to be some competition between the Navy and the R.A.F. in attracting men who are willing to become officers and pilots for a limited time. As shown above, the conditions of the two Services are far from identical, and there are certainly enough young men of adventurous spirit in the country to supply the needs of both.

Automaticity

NOW that flying machines and their equipment are, to all intents and purposes, completely reliable, the sole remaining cause of accident is that of human error. It is not, perhaps, very pleasant to find it necessary to blame a pilot who may not still be with us to defend himself, but, save for a few unimportant exceptions, the fact remains.

Present-day speed and navigational methods in the sort of weather in which it is customary for transport machines to carry on are such that the pilot to-day probably has far more on his hands than he can reasonably be expected to deal with. This is particularly the case during a blind or semi-blind approach, and any development which will help to take some of the work off the pilot's shoulders must be looked on as one of the utmost importance.

The automatic pilot is one such development, and comparatively recently work has been going on in the combination of this device with suitable means of radio guidance. Experiments on these lines have been made in America and elsewhere, and last week we had a chance of seeing a similar experiment, which has proved itself sufficiently accurate and reliable to be used in regular operations.

This combination marks the beginning, perhaps, of a new era in air transport. In its present form the arrangement is a simple one and not one that is necessarily applicable in all cases, but it at least points the way to future possibilities. In years to come we may reasonably hope that the entire work of flying a machine, from the moment of leaving the ground to that of landing, will be carried out accurately and automatically by some similar device or series of devices. When the pilot is freed from the immediate responsibility of holding his machine on a predetermined course he can concentrate entirely on what may broadly be called navigational problems—whether these are concerned with his position during a trip in terms of miles, or his position during an approach in terms of metres in the horizontal or vertical plane.

When the flying of the machine requires less concentration and effort than that involved in driving an express train (stokers excepted), and when the landing in almost any conditions of weather is virtually automatic with the assistance of the tricycle type of undercarriage, then transport operations may be expected finally to be more reliable and regular than those of surface conveyances.

Service Flying Boats

WHETHER or not we choose to recognise the fact, the American Navy is setting the world a pretty high standard in the matter of flying boat equipment and operation. The 255 Consolidated PBY twin-engined monoplane boats in service or on order (the great majority has been delivered) constitutes what is, perhaps, the finest long-range striking force in the world to-day; and that the U.S. Navy knows how to use it is proved by the magnificent "routine transfer" flights from San Diego to Honolulu and the Panama Canal Zone.

Last month a formation of eighteen PBY boats, manned by 127 officers and men, flew the 2,578 miles to Honolulu in 20 hr. 12 min. non-stop.

Achieved by a single machine this flight would have been creditable enough, but by a formation of eighteen it is, theoretically at least, eighteen times as notable. Curiously enough, the trip received little publicity.

The Waziristan Fighting

IT has always been very difficult to secure an impartial and authoritative opinion on the precise value of aircraft in military operations on the Indian Frontier. R.A.F. control in Iraq and the Aden hinterland is admittedly a great success, but the conditions on the Frontier are very different from those in the two areas just mentioned. One has many times heard R.A.F. officers who have been in India express wonder that the Air Force is not given a free hand to deal with recalcitrant Pathan tribesmen; while on the other hand champions of the Army maintain that the Air Force is, and can only be, a valuable ancillary to the ground troops.

The despatch of the Commander-in-Chief in India on a period of the operations in Waziristan last year, which has just been published, throws a little more light on the subject, but does not completely answer the question one way or the other. General Sir Robert Cassels says that three types of operation were carried out by the Air Force, namely, helping the troops in a battle, bombing fortified villages, and action against prescribed areas. About the utility of aircraft in helping troops in action in the Frontier hills there has never been any doubt. In the hills more than on any other sort of terrain the Army needs eyes, and when weather permits there is no form of reconnaissance to equal that from the air. During an actual engagement, too, when our infantry was advancing against entrenched positions of tribesmen, the bombing and machine gunning from the air helped the troops enormously; and when the enemy retreated the aircraft would harass them in a way cavalry could never do in the hills.

The Threat to Villages

IT is in dealing with air action against villages and proscribed areas that the Commander-in-Chief makes some striking admissions. Of course, warning is always given first, so that the inhabitants may clear out before the air action begins, and therefore the casualties are none, or very few. The General says that air action produced the surrender of hostages and of kidnapped persons (Pathans are Mussulmans, and are very fond of kidnapping rich Hindu merchants from the British side of the Frontier line) and that the mere threat of air action sometimes produced the desired effect without that action having to be taken at all.

It is, of course, common knowledge that that is what often happens in Iraq and the Aden hinterland, but there has been much doubt as to whether the Pathan tribes would be likewise submissive to air action or the threat of it. The Pathans are a very poor population, and an old proverb says, "it's ill taking the breeks off a Hielandman." Their villages are collections of rough stone buildings, usually with a tower or two. To knock these buildings about with bombs would certainly be a nuisance, but one would hardly think it would be a disaster to the hardy, indigent inhabitants. Damage to their crops and herds would naturally be more serious, but such losses usually have more effect on the rich than on the poor. The troops have destroyed crops and herds in the past.

However, we have the word of the Commander-in-Chief that air action or the threat of it has actually brought some Wazir villages to submission. The question then arises: should not this course of action be extended? Could not the Air Force reduce the whole of Waziristan to submission and hunt the Fakir of Ipi and suchlike firebrands out of the country? If it could, without a military expedition, the saving in money and in lives would be enormous. Yet, obviously, the Commander-in-Chief does not consider that the time has yet come when the Army can hand over the whole of the defence of the Frontier to the Royal Air Force. An official in his position has to consider cost very seriously, for he has to convince the Finance Minister of the Government of India that the expedition which he proposes is quite necessary. To suggest that the Commander-in-Chief, being a soldier, is animated entirely by prejudice in favour of his own Service is not a reasonable explanation. One would very much like to know what his reasons are.

ENGADINE EXPRESS

Non-stop to St. Moritz: An Experiment with Possibilities: The High-Altitude Landing Ground at Samaden: Some Comments from the Passengers' Point of View

AIR travel is still something of a luxury commodity, and it is only to be expected that those services which are useful to the holiday-maker should, generally speaking, be the most flourishing. The man or woman who is on vacation is not only ready and willing to pay for comfort, but is also especially interested in useful speed, since this speed inevitably lengthens the period of the holiday.

In this country, for instance, the most handsomely supported air services of the non-ferry type are probably those to Jersey and the Isle of Man, while, Continentally, Swissair's London-Zürich service is a particularly good example. The distance in this case is great enough to make air travel in the modern manner effective and saleable; the prospective traveller compares some twenty hours of earth-bound motion with a mere three and a half or less. In the summer the Zürich service is operated jointly by Imperial Airways and Swissair, but for reasons which are well known and which, in any case, cannot be gone into here, the Swiss company, with its Douglas D.C.2s and D.C.3s, have so far carried most of the traffic and have developed a reputation for reliability and safety which is second to none in Europe.

When Imperials take delivery of their new Ensigns, however, the position may be rather different, and it is possible that with these forty-seater machines arrangements may be made whereby complete parties, organised by the travel agencies, may go by air, thus helping to start another phase in air transport. If anything comes of this idea, Swissair will themselves need to purchase machines of the D.C.4 (the first of which has left the jigs) or big Boeing calibre in order to take their own part in the operations.

It is not, of course, possible to transport travellers actually to their destination, and the terminal in Switzerland is at Dübendorf airport, Zürich. There are, however, more than a dozen suitable aerodromes and landing grounds in Switzerland, and anybody who wishes to do so can, weather permitting, charter a machine at Zürich and so

The photograph on the left of the Oberland south of Glarus gives a good impression of the type of scenery which is enjoyed by the Alpine air traveller. Above is a snap of Swissair's Rapide taken while the two machines were flying in photographic formation over St. Moritz. (*Flight* photographs.)

complete the journey. For this purpose Swissair use a specially equipped D.H. Dragon Rapide which normally carries four passengers in considerable comfort with a very fair amount of luggage.

Since St. Moritz is one of the most popular resorts and at the same time lies some considerable distance from Zürich, it was natural that the authorities there and in the surrounding municipalities should interest themselves in the idea of a through air service. To this end they have laid out a strip landing-ground at Samaden, and during last week-end the first non-stop flight from London was made with a Douglas D.C.2. Some weeks previously take-off tests had been made with various loads—Samaden lies at 1,700 metres (5,600ft.)—and the aerodrome can be considered as being in every way safe and suitable for operations with a big machine in the hands of an experienced Alpine pilot—in this case Capt. E. Nyffenegger, the chief pilot of the company. Naturally enough, the municipalities of St. Moritz, Pontresina, Samaden, and others, are particularly keen that a regular service should be operated, but, even with present-day radio and other aids, the run can only be made with complete safety in good weather. Swissair are naturally reluctant to put such a service in time-table form when on many days it could not be run at all, and their reputation for safety is such that they could not afford to take any risks in attempting to make the run with anything resembling time-table regularity.

However, last week-end's non-stop trip showed what can be done in the good weather which is generally experienced during the winter at such altitudes, and that when a worthwhile party of travellers wishes to do so the service can be run, to all intents and purposes, as a regular one either directly from London or, in the case of small parties, *via* Zürich with the help of the Rapide. Our outward trip was made for the most part against a 35 m.p.h. headwind, but even so the flying time was a matter of little more than four hours, giving an average speed of 145 m.p.h. The effective non-stop range and usefully variable cruising speed of the D.C.2 were shown up to their best advantage. Needless to say, the machine arrived at Samaden with tanks which were comparatively empty, so that, in spite of an otherwise full load, no possible difficulties might be experienced in entering the landing ground. Depending on the load otherwise carried, the take-off from such a high-altitude aerodrome must be made with reduced fuel supply, and any return trip would be made with a refuelling halt at Zürich. Nevertheless, the load taken out of the aerodrome was such as to prove the complete safety of operations with the Douglas, the engines of which could not at that height give full take-off power.

Nowadays the D.C.2 cannot be considered as a really up-to-date type, yet it can still give a good account of itself in comparison with other and more modern transports. During the return journey, after a landing for fuel at Dübendorf, a glance at the instruments in the control cabin showed that we were cruising on 70 per cent. full power (a total of 1,000 h.p.) at an indicated air speed of 250 km.h. Our height was 3,000 m. (9,850ft.), and the outside air temperature was about −6 deg. C., and when corrections had been applied by means of one of the power charts carried by the Swissair pilots, the true air speed worked out at 300 km.h. (185 m.p.h.), a figure which, rather late in the day, perhaps, gives the lie to those who laughed aside the performance figures of the D.C.2 when these were first published in Europe some years ago.

Incidentally, Swissair make the best use of fuel characteristics for different purposes both with the D.C.2 and the D.C.3, each carrying specially high octane fuel for take-off purposes. The D.C.2 is taken off with fuel of the value of 87 octane, while cruising on 77 octane, and the D.C.3 takes off on 95 octane and cruises on 87. With the 95-octane fuel it is permissible, if necessary, to allow the manifold pressure to reach a maximum figure of nearly 100 cms. of mercury at something like 2,300 r.p.m.

Strip Airport

Samaden aerodrome is laid out in the valley of the Inn to the north-east of St. Moritz, and consists of a strip 800 metres long and about 200 metres wide, this strip being largely cleared of snow by means of a centrifugal sweeper. Except for short periods in the early morning and evening, the wind blows almost directly down the valley in one direction or the other, so that a two-directional strip is ample for normal operations. Actually, though the wind was not blowing at much more than five miles an hour when we landed and took off, the Douglas used only four or five hundred yards of the aerodrome, though at this height not only, as already mentioned, is the take-off power limited, but the stalling speed is quite considerably increased. The aerodrome was opened towards the end of

last month, and the combined hangar and office building was erected in a matter of two months—a shorter space of time than that taken by the Croydon authorities in *not* rebuilding the burnt-out hangar. The hangar at Samaden is large enough to take a machine of the Douglas size with room still available for smaller types. Actually, while we were there two Koolhovens were being used for joy-flying.

It is interesting to realise that, while all the other air companies in Europe appear to have suffered to smaller or larger degrees from the slump following the series of transport disasters late last year, Swissair's traffic figures have been almost unaffected. This fact certainly suggests that the traveller by air is far from being the layman he is supposed to be in the matter of distinguishing the different companies. In other words, he does not just travel by air, but by Imperial Airways, Swissair, K.L.M., and so forth and as the case may be; each separate company, therefore, can be expected to obtain the advantages of its own safety record, though the record of all air transport companies must inevitably have some effect on the temper of air travellers as a whole.

The casual passenger, particularly one who is using the air for the first time, should always be made to feel that the whole procedure is a perfectly normal one. When, in the comparatively early days, Imperial Airways began to employ stewards on their big machines the effect on the casual passenger must have been quite considerable. No passenger likes to feel that he is, so to speak, locked in a flying box for the duration of the flight, and that, whatever he may think or do, he will be ignored until this box is unlocked at his destination. Swissair, of course, have, during the last few years, employed stewardesses, and in many ways these are probably more likely to instil confidence than attendants of the male gender.

At the same time, this company is not too strict about such matters as entry into the control cabin during flight. Although in the ordinary way a passenger would not be permitted to go "up front," permission can be obtained when the weather conditions allow inspection and explanation without interfering with the business of navigation. Provided that he or she is ready to take an intelligent interest in the operational methods, some slight freedom of this kind can do nothing but good. When, while the machine is flying perfectly happily on its automatic pilot, the visitor can be shown how bearings are obtained and laid off, how the engines are controlled for maximum efficiency and economy, and how, in fact, the entire procedure is quite an effortless one, the passenger returns to his seat with an increased feeling of security and a greater interest in air transport as such.

* * *

At Samaden the party was welcomed by a number of local notabilities, lead by the Mayor of St. Moritz, and after dinner at the Suvrettahouse, where they were the guests of the town, the Mayor, who was in the chair, said he hoped that a regular connection between London and St. Moritz would eventually be made possible, and thanked the Swissair Company for their part.

Replying for the visitors, Capt. Norman Macmillan said that the journey had been completed in four hours in spite of a severe headwind, and spoke of Swissair's record of reliability during the past few years. He was supported by Mr. F. D. Bradbrooke who, enterprisingly and uninsularly, spoke in the German tongue. Thereafter the field, so to speak, was open to all-comers, among whom was Mr. Anthony Fokker, who is lucky enough to be able to spend two or three months every year at St. Moritz. In his contribution to the speechmaking he said that the town had only been "discovered" a hundred and fifty years ago, and that perhaps in five years' time it may be possible to fly direct from New York to St. Moritz in twenty hours. He paid special tribute to the work of Mittelholzer and Zimmerman, by whose deaths last year Swissair had suffered almost irreparable loss.

On the following day, while the machine was being refuelled at Dubendorf, the party was entertained to lunch by Swissair at the airport, and Herr H. Pillichody, joint managing director with Herr E. Groh again thanked the members of the party for coming over on the first through service to St. Moritz. Capt. Macmillan replied in suitable terms. H. A. T.

LUCKY THIRTEENTH

Annual Dinner of A.I.D. Technical Staff Association : 1,200 *Hosts and Guests*

AIR CHIEF MARSHAL SIR CYRIL NEWALL, Chief of the Air Staff, was the guest of honour at the thirteenth annual dinner of the A.I.D. Technical Staff Association, held at Grosvenor House, London, last Friday. In the course of a very excellent speech, the C.A.S. made a very neat point when he said that, although it is possible to "de-skill" jobs during manufacture of aircraft and aero engines, it is not possible to "de-skill" inspection.

Sir Cyril pointed out that the present international situation was grave, but that a strong Britain was a prime factor in maintaining peace. If members of the A.I.D. felt they were ploughing a hard furrow, he wanted them to remember that they were providing a shield for the country and for all that it stood for. Sir Cyril paid a warm tribute to the A.I.D. for the way in which it had kept up the standard of the equipment of the Royal Air Force in spite of the expansion.

Lt. Col. H. W. Outram, Director of Aeronautical Inspection, illustrated the way in which the expansion has called for effort in the industry and in the Air Ministry by pointing out that at the first annual dinner, held in 1925, the A.I.D. numbered something like 200. At the present time it numbered altogether rather more than 6,000. That total, of course, included the A.I.D. proper and the Approved Inspectors. He was glad that Sir Cyril Newall was satisfied with the work done by the A.I.D. during the last twelve months. What was even more important, *he* (Lt. Col. Outram) was satisfied. It was more important because he knew what had been done wrong, whereas Sir Cyril did not!

Mr. A. McIsaac, who was in the chair, gave a new definition of an optimist and a pessimist. His speech came between those of Sir Cyril Newall and Lt. Col. Outram, on the one hand, and Mr. Self and Mr. Handley Page on the other, and he defined an optimist as a diner who said there were still two speeches to look forward to, and a pessimist as one who said thank goodness two of the speeches were finished with, anyway. He was very glad to think that Mr. Handley Page had returned to his "Bible class" that evening!

Mr. A. H. Self, Second Deputy Secretary of the Air Ministry, proved himself a very witty and amusing speaker. He knew from experience how dangerous it was to give Mr. Handley Page the last word, and complained that he (Mr. Self) was the civil servant who had been wont to sit in silence and listen to the words of the mighty, trying afterwards to sort out the decisions, if any, to which they had come. Mr. Handley Page reminded him of Noah, not because of his benign and patriarchal countenance, not because *Hannibal* was now something of an ark among aircraft, but on account of his ability to speak comfortably. The recent criticisms of the industry in connection with delays in production were unjustified, and Mr. Handley Page was entitled to address words of comfort to his industry.

Mr. Handley Page, in his usual style, camouflaged a lot of sound sense under the appearance of badinage. Among the points made was that the aircraft industry, under the chairmanship of Sir Charles Bruce-Gardner, was determined to work as one unit for the benefit of the re-equipment of the R.A.F. and to get over the present difficulties. "We are all amateurs," Mr. Handley Page said, and when there were humorous protests, he added, "including the A.I.D. Greatness is not achieved by watching others work."

Referring to the greater freedom of manufacturers, Mr. Handley Page said that if a good man was given liberty and responsibility, he would do a good job of work. He referred to the need for trained engineers and the S.B.A.C. scholarship scheme, and expressed the hope that the Air Ministry would co-operate by introducing some of the boys in the technical grades of the Air Ministry. Mr. Handley Page concluded by quoting the words of Abraham Lincoln : "In charity towards all and malice towards none, let us carry on our good work."

After the dinner there was some very good entertainment, and the entire organisation was, as usual, a pattern of what such an occasion should be. Mr. "Jack" Jarvis was complimented on his effort, the thirteenth in the series of A.I.D.-T.S.A. annual dinners. What is not, perhaps, realised is that Mr. Jarvis does all the work at home, so that the fact that the Handley Page Harrows were completed three months ahead of schedule cannot be ascribed to Mr. Jarvis having been too busy with the dinner to hold up production.

February 24, 1938

Supplement to FLIGHT

THE AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

No. 165. (Volume XVI No. 2) 13th Year

February 24, 1938

WOODEN BLADES FOR V.P. AIRSCREWS

Interesting Developments Now Taking Place May Have Far-reaching Effects

(Illustrated by "Flight" photographs)

FOR a great number of years the wooden airscrew held undisputed sway. During the pioneer days of flying wood was the ideal material for airscrews as well as for aeroplanes, its low cost and the ease with which it could be shaped making it particularly attractive for experimental work and for construction in small quantities. In those days flying was done in fine weather only, and thus it did not matter that wooden airscrews were apt to suffer severely from the effects of flying in rain or hail.

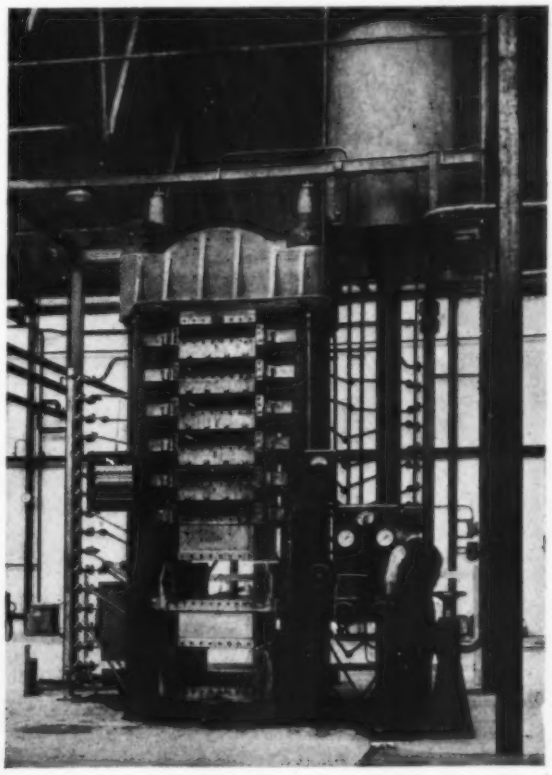
As the art of flying developed, aircraft ventured out in less favourable weather conditions, and the wooden airscrew was apt to suffer damage. Also, it was realised that its relatively thick blade sections were not quite as efficient as would be blades of thinner section, such as could be manufactured of metal. Successful metal airscrews were introduced and gave excellent results in service. The wooden airscrew, in spite of fabric covering and/or varnished surfaces, could not compete from the point of view of durability, and its popularity began to wane.

The next stage came when the speed range of aircraft had increased to such an extent that airscrews with controllable pitch were necessary if a good take-off were to be combined with high efficiency at operational speed. In view of the good service given by the fixed-pitch metal airscrew, it was natural that when the variable-pitch airscrew came to be developed it should have metal blades. Of variable-pitch airscrews with metal blades there are now several types in use and giving good service.

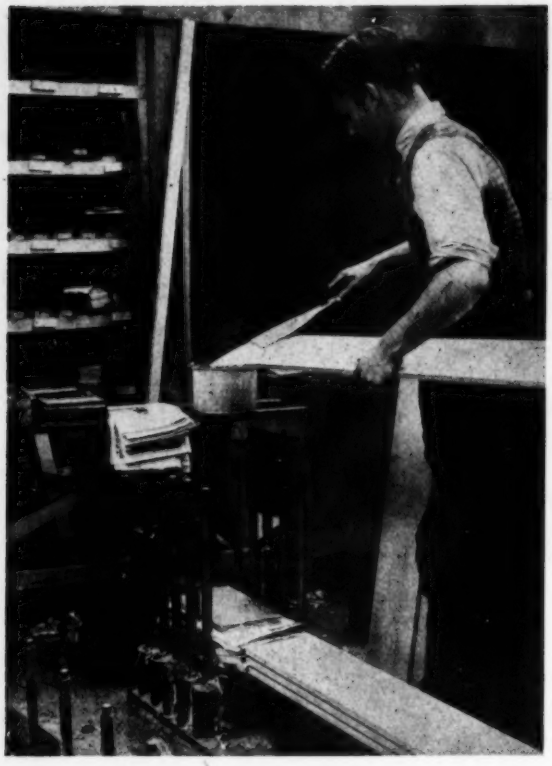
In the meantime, the champions of the wooden airscrew had not been idle, and they had succeeded in discovering protective coverings which would withstand the effects of rain and hail, not to mention prolonged operation in humid atmospheres, frequent spraying by sea-water, such as is associated with seaplane work, and so forth. One method in particular was evolved in Germany by the Schwarz firm of Berlin. The British rights in this method were secured by the Airscrew Co., Ltd., of Weybridge, and fixed-pitch wooden airscrews finished by the Schwarz process are now used very extensively in the machines of the Royal Air Force as well as in British civil aircraft. The process is well known, and consists in covering the wooden blades with a layer of nitrocellulose, the material being applied in sheet form and forced into the pores of the wood under air pressure in autoclaves.

It was inevitable that when the variable-pitch airscrew

The first stage. Impregnating a sheet of wood with synthetic resin.



Six blocks of wood being compressed under heat in the hydraulic press. Actually eight blocks can be compressed at a time.



Gluing the scarfed joint which secures the natural wood of the airscrew blade to the compressed wood of the blade root.

Finishing off a blade before the Schwarz finish is applied. Note the overlapping of the natural and compressed woods at inner end of blade.

came to be generally adopted in this country the question of wooden blades for them should arise. The ordinary wooden blades of the fixed-pitch airscrew were not suitable owing to the low shear strength of the wood, which made it impossible to get the blade roots to "stick" in the metal sleeves of the variable-pitch hub.

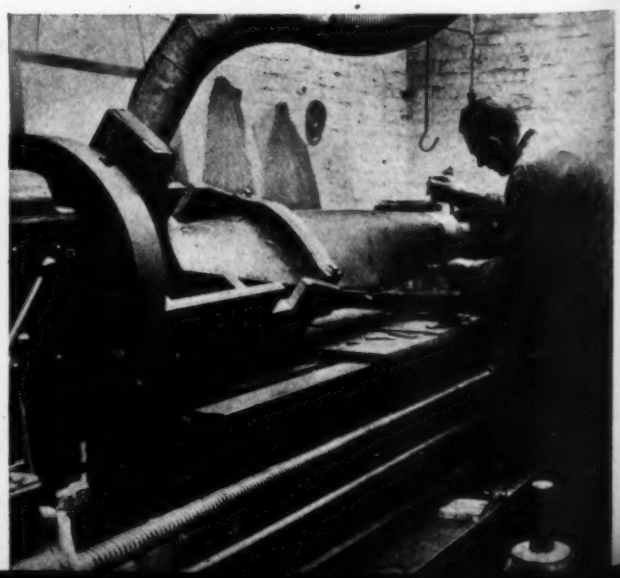
Then along came a Russian inventor by the name of Samsonov, who conceived the idea of improving the mechanical properties of wood by compressing it. Something more than mere compression was needed, however. A solution of the problem consisted in impregnating the wood before compression with a synthetic resin. Then, when the wood was compressed to the accompaniment of heat, the resin would flow into the cells of the wood, and when the resin had "set" it prevented the wood from subsequently swelling.

Sketched very briefly, that is the fundamental basis of the Samsonov process of compressing and impregnating wood. Its suitability for airscrew manufacture was obvious, since the blade root could be made of compressed wood, while the blade itself, not subject to such high local stresses as the root, could be made of ordinary light wood.

Much experimental and development work has been carried out at the Weybridge works of the Airscrew Co., Ltd., and a stage has now been reached when it may be said that the process of manufacturing airscrew blades of strength-graded wood is a practical proposition. Blades have been made for several types of modern high-powered aero engines, and have been subjected to all the usual airscrew tests, such as overload tests at higher revs. than would ever be reached in actual flight, tests on the whirling arm, and so forth. Actual flight tests should prove, during the next few months, whether or not the strength-graded wooden blade for v.p. airscrews is satisfactory. Results obtained hitherto justify an optimistic view.

Weight is, of course, the primary consideration. The

(Below) The strength-graded planks (left) for a blade being glued together in readiness for the shaping. On the right, the metal sleeve being finished off.



metal blades used in variable-pitch airscrews, be they made of duralumin or magnesium, are comparatively heavy. The long cylindrical blade root is of considerable volume, and lightening by boring out cannot be carried beyond certain limits. Hollow metal airscrews, using sheet steel joined by welding, have been tried, and for the first few hours gave good results. It was, however, found that eventually fatigue cracks developed, and no amount of redesigning seemed capable of curing the trouble. Dr. H. C. Watts, now technical director of the Airscrew Co., Ltd., was formerly connected with the Leitner-Watts Airscrew Co., which did a lot of development work on the welded sheet steel type of airscrew, and in the end he had to admit that he was defeated, as far as that particular line of development was concerned.

This question of fatigue cracks is still of importance. For several years now there have been no cases of variable-pitch airscrews breaking their blades owing to this trouble, but extremely careful manufacture, and inspection both during manufacture and in service afterwards, are necessary to avoid the trouble. Wood is a very good absorber of vibrations, and so on this score as well as on the score of weight the wooden blade has something to recommend it.

Saving Weight

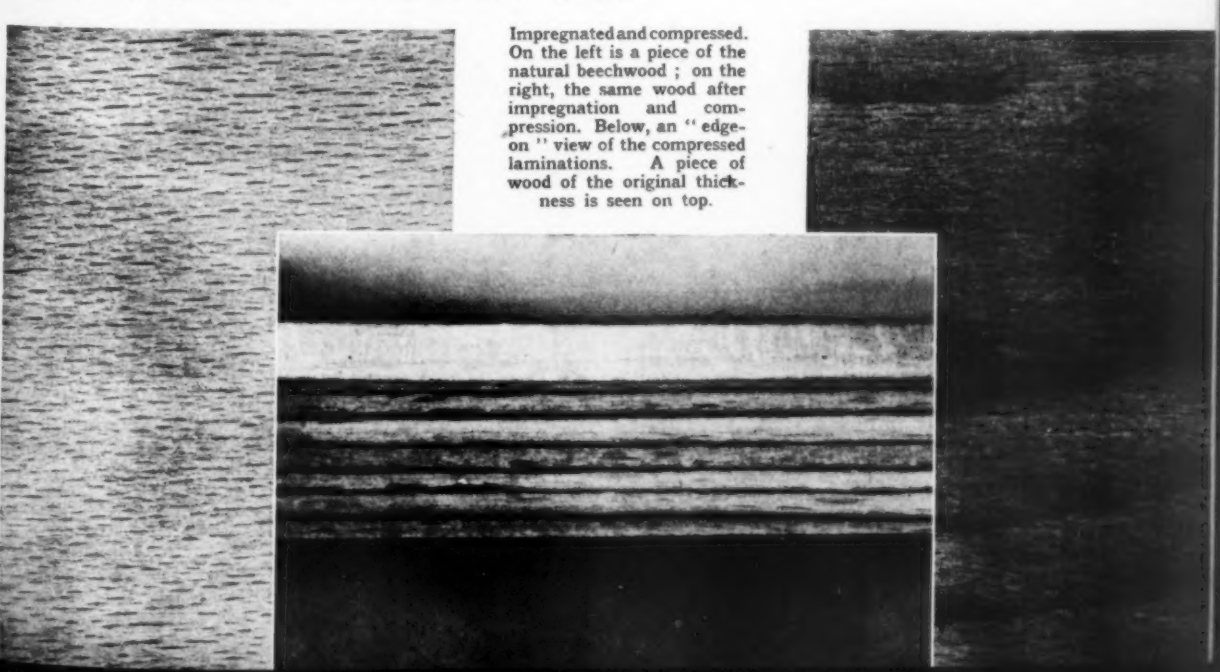
How much weight can be saved will depend partly upon the extent to which the mechanical properties of wood can be improved by compression and impregnation and partly on the power of the engine. The more powerful the engine the greater, proportionally, will be the weight saving. For engines in use at present the weight of the wooden blades may be some 65 per cent. of the weight of the corresponding metal blade. Engines of 2,000 b.h.p. are now visualised as possibilities of the immediate future, and Dr. Watts estimates that for such powerful engines the variable-pitch airscrew with wooden blades might be made for approximately one half the weight. It is only necessary to realise that on a Short Empire boat, for example, the weight saving might amount possibly to 200 lb. per engine to see the effect on performance and pay load of introducing wooden blades.

Such woods as beech and birch weigh about 44 lb./cu. ft. These woods, treated by the Samsonov process of compression and impregnation, have their density increased to 85 lb./cu. ft., and this does not necessarily represent the optimum. At the same time the mechanical properties have been vastly improved. For instance, a tensile strength of 40,000 lb./sq. in. is an average figure. The strength in compression (end grain) is 25,000 lb./sq. in., and the shear along the grain 6,000 lb./sq. in.

In connection with these figures it should be pointed out that the advantage of light wood blades and compressed wood blade roots is cumulative. The compressed wood is in itself much stronger than the natural, and the use of natural wood for the outer two-thirds or so of the blade reduces centrifugal loads very materially. Thus not only is the wooden blade lighter than the metal blade, but the fact that its centre of gravity is situated closer to the hub means that the stresses in the latter are reduced, and the metal hub itself can be made slightly lighter.

At Weybridge the plant necessary for the manufacture of detachable wooden blades for variable-pitch airscrews has now been installed and blades for any engine can be produced.

Two of the blades of a three-bladed airscrew, with their hub. On the right may be seen the threaded blade root and its metal sleeve.



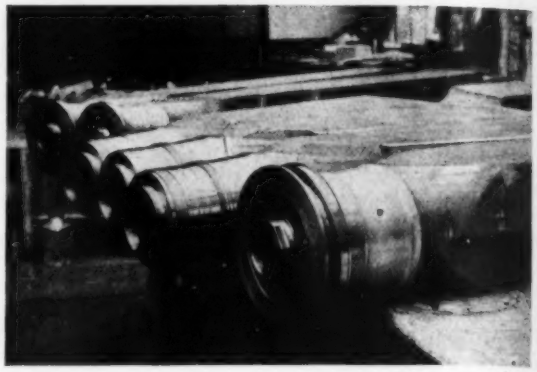
Impregnated and compressed. On the left is a piece of the natural beechwood ; on the right, the same wood after impregnation and compression. Below, an " edge-on " view of the compressed laminations. A piece of wood of the original thickness is seen on top.

After leaving the drying kilns the wood is impregnated with synthetic resin by being passed between rollers, as shown in one of the photographs. Stacks of these impregnated sheets are then passed on to the hydraulic press in which heat is administered at the same time as pressure. A total of eight of these stacks of wood can be placed in the press at the same time, so that eight compressed blocks are "manufactured" in one operation. The period necessary is less than one hour, depending upon the thickness of the blocks being made, the wood used, and similar considerations. During the compression process the wood is prevented from expanding laterally.

After leaving the press the compressed wood panels are cut up into standard size planks or boards, the ends chamfered and glued to the similarly chamfered ends of the natural wood boards When the scarfed joints are dry these composite planks are glued into complete blocks, ready for shaping. The process of shaping the blades is similar to that used for ordinary fixed-pitch wooden blades, with the exception that for the blade roots wood-working tools cannot be used, metal-working tools being employed instead.

The root of the blades are inserted into metal sleeves, a very coarse thread being cut on the blade root to correspond with an internal thread in the sleeve. To prevent any possibility of "play" between the blade hub and the steel sleeve a cement is forced into the space between the two. This cement has the peculiar quality of expanding as it sets, so that any minute gaps between the steel and the wood are effectively filled. At the ends of the sleeve rubber rings are inserted, and the joint made perfectly weatherproof by spinning over the edge of the sleeve.

In Germany the Schwarz Company uses mostly beech for the compressed blade roots. That is because beech is indigenous to Germany. In this country birch is more plentiful and may possibly be used. The weights and mechanical properties of these two woods are so nearly identical that the substitution of one wood for the other will have no appreciable effect on the quality of the finished article.



Sleeved blade blanks for a De Havilland v.p. airscrew (in the foreground) and for a Rotol airscrew.

Mention has already been made of the weight saving upon which Dr. Watts counts, a matter of some 200 lb. per airscrew in the case of the Bristol Pegasus engine. Actual figures are not available for typically British-built wooden-bladed v.p. airscrews for British engines, but the following figures for similar airscrews built in Germany will give an indication of the sort of weights obtained with the Schwarz v.p. airscrews:

Engine	B.H.P.	No. of Blades.	Dia. ft.	Weight lb.	Distance of c.g. from root ft.	Weight per h.p. (lb.)
As 10	240	2	7.85	45.3	0.79	0.19
BMW IX	900	2	10.25	102	1.07	0.11
RR Kestrel ...	575	2	11.5	137	1.23	0.24
Sam 22 B... ...	660	3	11.8	166	1.21	0.25
BMW VI U ...	730	3	12.8	180	1.37	0.247

United Steels at Birmingham

THE Birmingham Office of the United Steel Companies, Ltd., has been moved from the old Martino Steel Works in Princip Street to a more accessible spot in the centre of the city—Union Chambers, Temple Row, Birmingham (Midland 6231).

Chains in Aircraft

MOST people know of the proverbial Tommy Rose telegram, sent home on one of the rare occasions when that famous pilot failed to break an air record—"Sorry, chain came off bicycle."

Actually, and more seriously, quite a large amount of chain is used on a number of modern aircraft. It is all small-gauge—up to the size of cycle chain—and is used chiefly for controls, for operating starter magnetos, and for emergency hand operation of undercarriages.

In their large and well-laid out works at Didsbury, Manchester, the Reynolds and Coventry Chain Co. make every type of chain, from the smallest to large flat-link conveyor chain The type used in aircraft is assembled by very ingenious machines which have links, rollers and pins automatically fed to them. Inspection and testing of the finished product is an exceptionally thorough process. The links are visually scrutinised by works inspectors and approved inspectors: they are tried over standard teeth, stretched, run in, re-inspected and tested for amount of stretch. The limits allowed are an extremely small percentage of the total length of a chain.

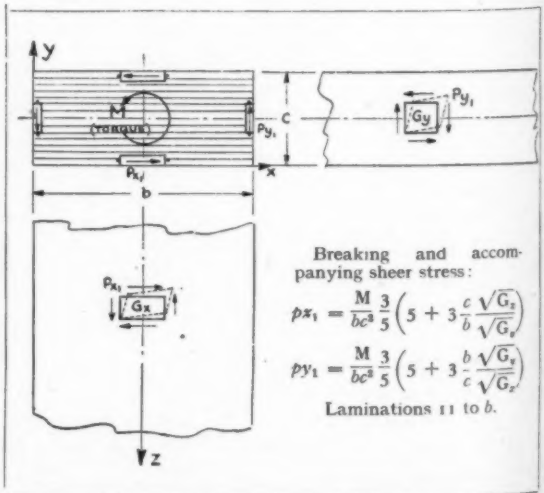
The firm are now building a large new stores department, for, although their premises are already big, much room must be found for the designing, servicing and assembling of most of the specialised machine tools; for a pattern shop; for cutting of teeth and finishing of wheels; and for large numbers of press tools.

The careful baling and disposal of scrap and swarf is characteristic of the systematic methods noticeable from the now overflowing material stores throughout the works to the final despatch.

Laminated Wood in Torsion

MR. E. REISSNER has asked us to publish the accompanying revised version of Fig. 7 of his article on "Improved Laminated Wood in Torsion," which appeared in the January 27, 1938, issue, as the original contained some errors.

We would take this opportunity to point out, what most readers who studied the article will already have understood, that in the formulæ (1) to (8a) cases occurred of the factors x and y being erroneously printed as suffixes to instead of as factors.



Breaking and accompanying sheer stress:

$$p_{x_1} = \frac{M}{bc^2}\frac{3}{5}\left(5 + 3\frac{c}{b}\frac{\sqrt{G_z}}{\sqrt{G_x}}\right)$$

$$p_{y_1} = \frac{M}{bc^2}\frac{3}{5}\left(5 + 3\frac{b}{c}\frac{\sqrt{G_z}}{\sqrt{G_x}}\right)$$

Laminations 11 to *b*.

TWO-STROKE AERO ENGINES

A Summary of Their Advantages and Disadvantages, and Some Speculations on Future Developments

By F. UMPLEBY

THE two-stroke cycle engine is passing through, or just emerging from, a period of transition in its development. In this new departure resonating oscillations are created in the exhaust pipe, by the first blast of exhaust gas, and the oscillations are utilised to scavenge and charge the cylinder. This may lead to the production of a simple, light, powerful and reliable engine which can be manufactured at a most economical figure, since, except for the crankshaft, the only two essential moving parts required, per cylinder, are the piston and connecting-rod. All the usual mechanically driven scavenge pumps or blowers are eliminated, except, perhaps, a small inertia blower to be used when starting up the engine.

Engines operating on this system are being marketed by Petters, Ltd., and their possibilities are being investigated by Armstrong Securities, Ltd., in England, and by Kadenacy in France, Westinghouse in U.S.A. and Wilin in Poland. Unsupercharged, these engines would be suitable for moderate altitudes. Larger engines for higher altitudes would, of course, be supercharged by means of an exhaust-gas turbo-supercharger designed to utilise the first blast of exhaust gas energy without destroying the depression created behind the blast.

Comparisons

When four-stroke and two-stroke cycle engines of the same bore and stroke, running at the same speed, are compared, the flow of heat energy to the two-stroke, if the same amount of fuel and air are being completely consumed per cycle, will be double that of the four-stroke.

The flow of heat going to waste will also be double that of the four-stroke, and it is the waste heat that makes trouble, which manifests itself in various ways. In engines provided with overhead poppet exhaust valves the valve heads burn out and the cylinder heads crack between the valve seats. In addition, it is almost impossible to operate the valves efficiently at high speeds, as their period of opening is only about 120 deg. of crankshaft travel against 240 deg. in the four-stroke, and they must operate at double speed if the engines are to be run at the same speed.

The flow of exhaust gas being double, steps must be taken to cool the barrel of the cylinder and the exhaust port belt. This is done on the Junkers engine by locally increasing the velocity of the cooling water. Fortunately, it is the intensity of the heat and not the quantity which gives most trouble.

Where the piston is used to control the exhaust ports it has to contend with its ordinary double share of waste heat as a piston and act as an exhaust valve in addition. Thus, here again, special precautions must be taken to facilitate the flow of heat from the piston crown to the cooler walls of the cylinder. Where a ring of piston-controlled exhaust ports is used, the length of the piston skirt must be increased to prevent the ports being uncovered at the top of the stroke. This also involves an increase in the length of the cylinder barrel and connecting-rod, accompanied by a corresponding increase in engine weight.

From an aero-engine point of view, this increase in weight is not at all welcome, but it is not altogether a disadvantage from an endurance point of view, because the thrust per square inch of piston in contact with the cylinder wall is reduced, and the area of contact for heat flow is increased

The piston must also carry an effective oil scraper ring at the bottom of the skirt to prevent loss of lubricating oil through the ports which are overrun by the gas seal rings each stroke. The gas forces in a two-stroke engine predominate over the inertia forces and may give lubrication troubles at the gudgeon pin

The constancy of pressure in one direction also increases the severity of the conditions imposed upon the top piston ring, as the ring is held constantly, by gas pressure and inertia, against the lower edge of its groove. The consequence is that the stagnant oil behind the ring may be baked into a carbonaceous cement which finally sticks the ring in its groove. The gudgeon-pin lubrication trouble may be overcome by using a knuckle joint instead of the usual type of gudgeon pin, and Junkers use a solid L-shaped top piston ring, something like a Gnome obturator ring, neither of which rings is required in a soundly designed cylinder barrel.

The inertia forces on the crankpin of a four-stroke radial engine are a limiting factor against high speed, but there is little doubt that there should be a substantial advantage here in favour of a two-stroke radial engine.

Hitherto one of the outstanding difficulties in connection with a two-stroke radial engine has been the difficulty of scavenging and charging the engine, since crankcase compression was impossible; but exhaust gas velocity and turbo-scavenging have changed the whole outlook.

Recent developments, now to be described, have solved this problem by even more simple and efficient means than the scavenging stroke of the four-stroke cycle engine.

These developments in connection with two-stroke cycle engines are described more fully in articles by S. J. Davies, D.Sc., M.I.Mech.E., in *Engineering*. June 18th and 25th, 1937. The research was carried out on engines designed by M. Michel Kadenacy. During the tests it was found that immediately the exhaust port opened the exhaust gases left the cylinder as a compact mass with a ballistic velocity exceeding that of sound in high-temperature gases.

This rapid evacuation of more than 50 per cent. of the cylinder contents leaves behind it a dapression in the cylinder exceeding half an atmosphere, with the exhaust gas residue moving rapidly towards the exhaust ports The evacuation was completed in a definite period of time, about 0.003 sec., and did not depend upon the size or length of the exhaust pipe, provided steps were taken to prevent return surges of the air or gas in the pipe re-entering the cylinder. This point is quite neglected in the ordinary four-stroke engine.

Confirmation

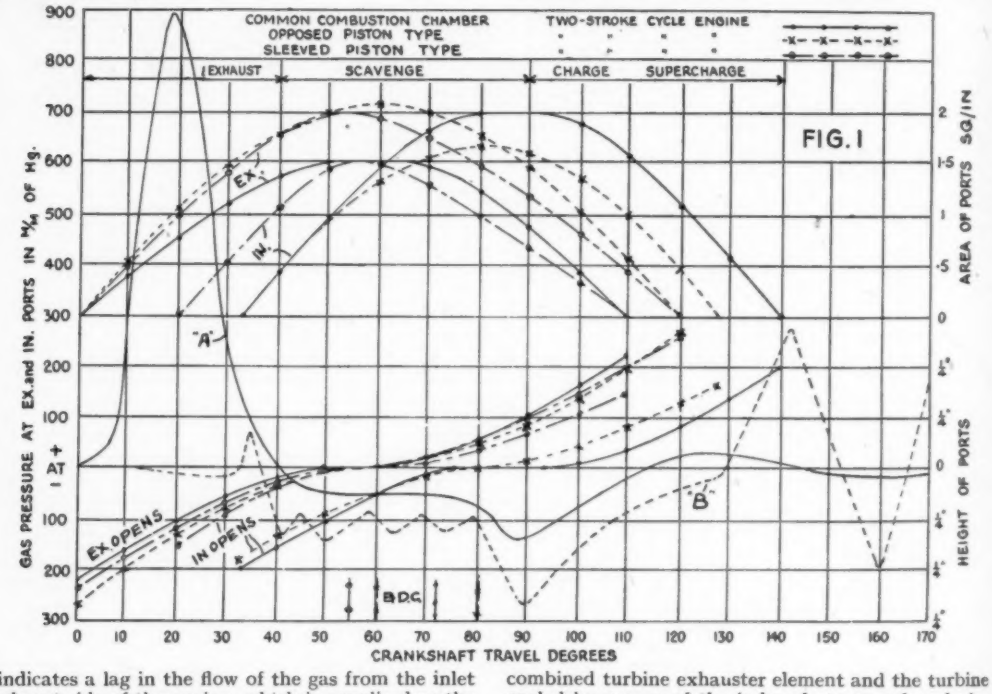
These preliminary conclusions were confirmed on a commercial type of Junkers engine modified in accordance with the "Kadenacy" patents, one of which modifications was to remove the Junkers scavenge air pump. The exhaust pipe was fitted with a pitot tube so arranged that the gas pressure variations could be observed and measured stroboscopically in relation to the speed of the crankshaft in degrees

Two hypothetical gas pressure curves, A and B, Fig. 1, are given. The early parts of the curves are based on two of Dr. Davies' curves, and the latter parts are slightly smoothed out and modified to suit the port action of the common combustion chamber engine pistons. Dr. Davies found that after a short delay, following the opening of the exhaust port, the pressure in the exhaust pipe increased rapidly to 33½in. of Hg. and then decreased with equal rapidity (see curve A, Fig. 1), until at 40° it reached atmospheric pressure. From this point the curve is based upon the common combustion chamber engine.

The pressure continues to fall, and there is first a slight depression, and between 85° and 95° a depression of 5½in. of Hg. After 95° the depression decreases until at 115° it

is destroyed, and atmospheric pressure is reached as the gases compressed in the pipe rebound. Slight fluctuations in pressure follow which are gradually damped out. The first rapid increase in pressure, and the equally rapid decrease, occur within a time interval of about 0.003 sec., and the depression exists along the pipe and continues until the gases previously lying in the pipe are compressed sufficiently to set up a return surge of gas pressure. The result is that the exhaust gases are progressively pushed out of the end of the pipe or silencer into the atmosphere.

Consider now the resultant pressure fluctuations on the inlet side of the engine. These are shown by the dotted curve B on Fig. 1. At the instant the inlet port opens there is still a positive, but rapidly falling, pressure on the exhaust side, a positive pressure in the cylinder, and a slight blow-back is indicated. But a depression of greater magnitude than the exhaust side depression immediately manifests itself and persists throughout the whole of the "inlet-open" period.



This indicates a lag in the flow of the gas from the inlet to the exhaust side of the engine, which is equalised as the kinetic energy of the rapidly moving column of gas on the inlet side is converted into pressure energy as the inlet ports are closing, and a series of positive and negative pressure waves follow. This inlet curve is also based upon the common combustion chamber timing from 100° onwards.

It is remarkable how closely the inlet depressions follow those created by the rapid ejection of the first blast of exhaust gas Tests with exhaust pipes of varying length indicate that the length of the pipe has but little effect upon the rate of evacuation of the first blast of exhaust gas, but increases in the length of the pipe increases the period for which the depression persists behind the blast. There is, however, a limit to the length of pipe that may be used without the opposite effect manifesting itself.

In Fig. 2 are given power and fuel consumption curves extracted from Dr. Davies' article, and it may be noted that from 1,200 r.p.m. upward, so efficient was the scavenging and charging process when running under full load, high B.M.E.P. and intense exhaust blast conditions, that the volumetric efficiency exceeded 100 per cent., based on piston-swept volume by measured air consumption.

This system of scavenging and charging a two-stroke cycle engine gives the simplest possible engine design. If the exhaust pipe system proves to be too cumbersome, due to the length and number of exhaust pipes (since it may not be possible to exhaust more than two cylinders into one pipe), other methods of extending the depression period are available which do not depend upon the length of the exhaust pipe to be used. This simple engine, operating upon the Kadenacy or Petter's harmonic system, with its two moving parts per cylinder, piston and connecting rod, connected in numbers to a crankshaft, without any scavenge pump, would be suitable for flight up to moderate altitude, and would be ideal for light aeroplanes.

More powerful engines for higher altitude flight would, of course, have to be supercharged, and here, as in the exhaust pipe scavenge system, it is the exhaust gas energy, which is usually wasted, that is used to do the work and drive an exhaust-gas turbo-supercharger.

The turbo-supercharger may be so designed as to make full use of the first blast of exhaust gas energy without destroying the depression behind the blast. The depression may even be prolonged and intensified by means of a combined turbine exhauster element and the turbine wheel cooled by means of the induced stream of cool air.

Consider now the three types of valveless, uniflow scavenge, two-stroke cycle engines, shown in skeleton form on Fig. 3, all of which are of the same capacity and drawn to the same scale.

The Junkers is well known, but it is an awkward engine and requires two crankshafts and two crankcases, and to reduce its weight the stiffness of the cylinder barrel is reduced to a distortable minimum.

The "Zoller" type, with its common combustion chamber, is not an easy proposition to machine all over, but the materials now available in cast form render its manufacture a sound proposition from an economical manufacture point of view. It only requires one crankshaft, and it possesses excellent inlet and exhaust port operation and timing.

The third type, originated by the writer in 1909, is machinable all over, but its cylinder and piston are on the long and heavy side. The engine as a whole is not so long or so heavy as the Junkers; its inlet and exhaust port timing cannot be varied independently of each other, but it is better in this respect than the Scott type, which has not got uniflow scavenge, and has its inlet and exhaust ports all situated at the same level.

One feature of the high-speed two-stroke cycle engine which is often emphasised is the early opening of the

exhaust ports and the resultant loss of expansion ratio. Where, however, the uniflow scavenge system is used, not only is better scavenging obtained, but the inlet and exhaust ports are not situated at the same level; therefore, the ports can be reduced in height, a later opening be obtained, the expansion ratio increased, and still have sufficient port area for high speeds.

Furthermore, during the period when the ports are full open the piston stops and reverses its stroke, and it is moving with its minimum velocity for about 30 crankshaft degrees on each side of the dead centre. This movement may be prolonged on the closing side by offsetting the centres of the cylinder and crankshaft. The light thrown on the actual exhaust and inlet gas velocities and depressions by Prof. Davies indicates that any difficulty here can be eliminated.

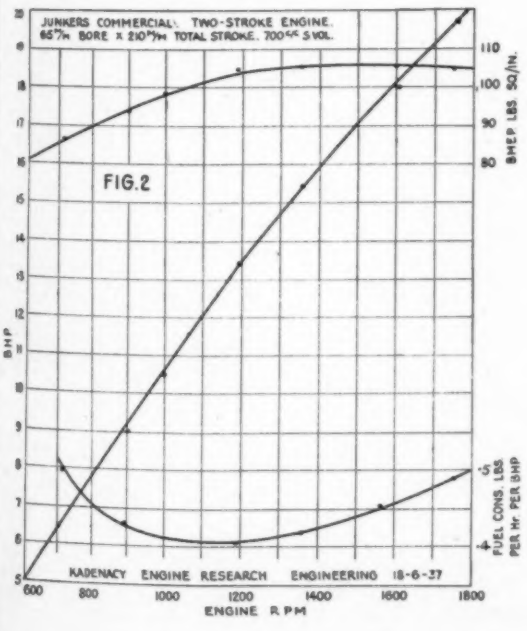
Port Timing

On Fig. 1 is shown, approximately, the port opening path, port timing, area, and the periods during which the exhaust, scavenge, charge and supercharge may be said to occur for the three engines illustrated on Fig. 3.

In the common combustion-chamber engine the exhaust port opens 72 crankshaft degrees before bottom dead centre of the exhaust piston and is almost full open when the inlet port is first opened by the inlet piston 33 degrees later. Due, however, to the differential stroke action of the pistons, the inlet piston does not reach bottom dead centre until the crankshaft has travelled 80 degrees, and as a result of the same action the exhaust port closes 30 degrees before the inlet closes.

This 30 degrees is available for supercharging because, since the exhaust ports are closed, gas losses through the exhaust ports cannot occur, and it is during this 30 degrees that the depression on the inlet side is converted to a fairly high positive pressure, as is shown by curve B.

On the opposed-piston type of engine the port opening and closing periods are varied and controlled by variation in the height of the ports and by setting the crankshaft connected to the inlet position so that it reaches bottom dead centre later than the exhaust piston. This is shown on Fig. 1, where the inlet piston is set 20 degrees behind the exhaust, at 60-80 degrees respectively. Both ports open at the same points as those on the common combustion-chamber engine, but even so the inlet port is only open for 8 degrees after the exhaust port has closed, and very little time is available for supercharging with the inlet open and the exhaust closed.



The inlet ports in the sleeved-piston type of engine, with ports cut in the sleeve, are controlled by the inwardly projecting cylinder head. The position of the inlet and exhaust ports in this engine can, of course, be reversed. They are the most shallow of the ports illustrated, but even so they open within 20 degrees of the exhaust port opening point, at which point the maximum pressure due to the first blast of exhaust gas (see curve A) has just been passed; the inlet would be subject to heavy blow-back, since the pressure in the cylinder is still high, unless supercharged at higher pressure. The inlet also closes 10 degrees before the exhaust port, at 110 degrees and 120 degrees respectively. Thus, the most favourable engines, from a port operation and gas flow control point of view, are the common combustion and the opposed piston types, but they are mechanically the most awkward.

The port area curves show the area of the respective inlet and exhaust port openings at any instant, read vertically from the zero line. On the right, below these, are shown the height that the respective ports are open at any instant, with the opening points below and the closing points along the zero line; each square represents a quarter-inch of opening or closing. It will be noted from these curves that the rate at which the ports open or close decreases as the piston approaches the full open position, and that the curves cross the zero line at an acute angle. This is due to the piston travelling at its minimum velocity at this point. The same feature is manifest on the port area curves; indeed, to some suitable scale and engine speed these curves would form a piston velocity curve.

Informative Curves

The whole of the curves on Fig. 1, set out as they are on a crankshaft degree travel base, are most informative and form an interesting study of the gas pressures and velocities in relation to the port sizes and the opening and closing points and their periods.

There is considerable prejudice against the two-cycle engine, but, as we have already seen, modern instruments have enabled us to gain a much wider and a more correct knowledge of what really happens in the gas-flow system of the engine. The materials used in the construction of the modern four-stroke cycle engine now make it possible to build two-stroke engines able to stand up to the extra heat flow and stresses involved.

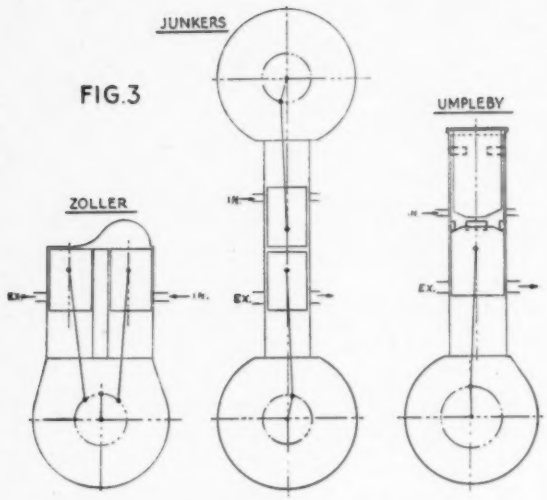
One of the greatest of the obstacles to two-stroke cycle engine development has been its excessive fuel consumption, but a few two-stroke engines now have a fuel consumption equally as low as that of their corresponding four-stroke cycle prototype. One solution of the fuel-consumption problem lies in the use of fuel injection and compression ignition; here the fuel is injected into the combustion chamber after all the ports are closed, and there can be no loss of unburnt fuel through the exhaust ports.

It may be that in the common combustion-chamber engine operating on the compression-ignition system we have the aero engine of the future, combining, as it does, favourable port control without valves, minimum weight possibilities, and the ability to run at high speeds.

Bi-fuel Systems

Another method of reducing fuel consumption is to inject high-octane fuel into the cylinder early in the compression stroke, but after all the ports are closed, and ignite the mixture electrically. High B.M.E.P.'s and high speeds have been attained by this method. Unfortunately it adds to the complexity of the engine and involves the weight of two sets of fuel injection-ignition systems, but the extra weight is more than regained by the extra power developed, and a low ignition point fuel can be used.

To obtain maximum power from an engine of a limited capacity it must be run at high speed, and a lower cruising speed must also be provided for. Both speeds must be economical fuel consumption speeds, and it is quite feasible to design the port sizes and opening periods in such a way that there is no loss of unburnt fuel through the exhaust ports. This can be done by using a sandwich system, where first pure air is admitted for scavenging, and then a



Diagrammatic representation of the three types of two-stroke discussed by Mr. Umpleby. Each type has certain advantages and certain drawbacks.

rich mixture of fuel-air, followed by more pure air, and thus finally fill the cylinder with a correctly proportioned combustible mixture at both the maximum and cruising speeds.

The compression-ignition engine operates at high maximum cylinder pressures, and this demands a correspondingly rigid construction, but the use of high-octane fuel and increased compression ratios are fast reducing any advantage the petrol engine may have had from a lower maximum pressure point of view, and the compression-ignition engine is fast losing any advantage it had from a lower fuel consumption point of view. The compression-ignition engine and the high-octane fuel engine would thus be in an almost equal state so far as fluctuation of maximum to mean torque is concerned, but, for a given number of cylinders, the two-stroke engine would score heavily by reason of its greater uniformity of turning moment.

The radial two-stroke engine would not be limited to an odd number of cylinders; with either an odd or an even number of cylinders the power impulses would follow each other continuously around the circle as the crank revolved. Probably an even number would best suit the exhaust blast energy exhaust pipe or exhaust blast energy turbo-blower supercharged engines.

In-line Difficulties

In the case of vee engines with the cylinders in line it might be difficult to reconcile the requirements of dynamic balance with those of uniform turning moment, but the difficulty might be overcome by setting the cylinders at other than the usual angles, by using cylinder blocks in other combinations, or by using H-cylinder arrangements.

In a cylinder of given swept volume the engine weight would not be affected as far as gas pressure stresses are concerned. If equal mean effective pressures were obtained at equal speeds, then the weight per b.h.p. would, in the two-stroke engine, be half that of the four-stroke. In the two-stroke engine all the weight of the valves and valve-operating mechanism would be eliminated, and this would more than compensate for the extra weight required for longer cylinder barrels and pistons. In the simple exhaust blast scavenged engine a reduction in weight per b.h.p. would undoubtedly be shown, and also in the exhaust blast energy turbo-scavenged supercharged engine, when compared with a complete supercharged four-stroke engine.

It is yet too early to say that these simple two-stroke cycle engines can attain and maintain a B.M.E.P. equal to that of a four-stroke cycle aero engine, but if they can attain 60 per cent. of that their utter simplicity and ease of manufacture would warrant full research into their design for times of national emergency.

Really authentic performance data for modern two-stroke cycle engines are very scanty, but I have collected into the following table such data as I have been able to gather, and have appended at the end corresponding data for a modern aero engine. Using the power output in b.h.p. per litre of engine capacity as a common base of engine performance value, it will be noticed that two of the two-stroke cycle engines claim a performance value of more than double that of the four-stroke engine, and that another two engines also claim an increase in performance value, even if not so high as the previous two.

Few Parts

It is, however, when we consider the possible reduction in essential parts required for the four-stroke engine (they must approach 800 for valves and valve-operation parts in the example quoted) that we realise that the two-stroke cycle engine now demands serious research effort if we are to maintain our national lead in aeroplane engines. It is true the four-stroke cycle engine quoted is a very powerful engine, whilst the two-stroke cycle engines are of a comparatively low power output, but if the Zoller engine without increasing its capacity per cylinder (they are only 125 c.c. each) had its number of cylinders increased to 48 and arranged in H formation, and its pistons connected to two six-throw crankshafts, its performance, if all that is claimed for it be true, would almost be equal to that of the large four-stroke.

Alternatively, the capacity of each cylinder could be increased to 500 c.c., without serious trouble, and their number be reduced to 16, with their pistons connected to two short, stiff two-throw crankshafts, and if the power output be maintained at the same rate per litre it would exceed 1,000 b.h.p.

Furthermore, it may well be that the engine of the future for commercial aeroplane work will be the compression-ignition engine working on the two-stroke cycle. It will be noted that the simple exhaust blast energy scavenged engine has a performance equal to more than 50 per cent. of that of the four-stroke cycle engine, and its low first costs and low fuel and maintenance costs will be accompanied by increased reliability because there is less mechanism to give trouble.

TWO-STROKE CYCLE AERO-ENGINES

Engine.	Cylinders.				Capacity.		Type of Engine.	Supercharger or Scavenge System.	Maximum.			Fuel Type.	Fuel cons. Lbs. hr. B.H.P.
	No.	Pistons No.	Bore mm.	Stroke mm.	Litres.	B.H.P. per litre.			R.P.M.	B.H.P.	B.M.E.P.		
Zoller	6	12	43	84	1.5	133	Common comb. chamber.	Zoller vane type super.	5,500	200	161	Petrol	—
Wichite air-cooled Radial.	10	20	79.4	95.2	4.7	28.8	"	Blower	1,800	125	100	"	.55
Junkers Aero ...	6	12	105	160×2	16.62	40	Opposed piston	Centrifugal blower...	2,400	655	104	Fuel oil	.375
Kadenacy Junkers	1	2	65	105×2	.70	28	"	Exhaust blast energy	1,750	19.72	105	"	.487
Fiat	4	8	58.5	69×2	1.5	113	"	Roats type blower...	6,000	170	125	Petrol	—
Causen	4	8	60	66×2	1.5	93	"	"	4,400	140	142	"	—
Causen Aero ...	8	16	95	106	12	54	"	"	3,000	650	116	"	—
Kochlin	4	4	84	186	4.11	25.6	Sleeved piston	Stepped pistons ...	1,600	105	75.5	"	—
Napier Dagger ...	24	24	97	95	16.9	50.3	Four-stroke ...	Centrifugal supercharger.	4,000	850	164	87 Octane	—

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

MR. N. K. JOHNSON, M.Sc., A.R.C.S., has been appointed Director of the Meteorological Office on the retirement of Sir George C. Simpson, K.C.B., C.B.E., D.S.C., F.R.S., which will take effect in September.

South African Airways have ordered two more Junkers of the *Grosser Dessauer* type.

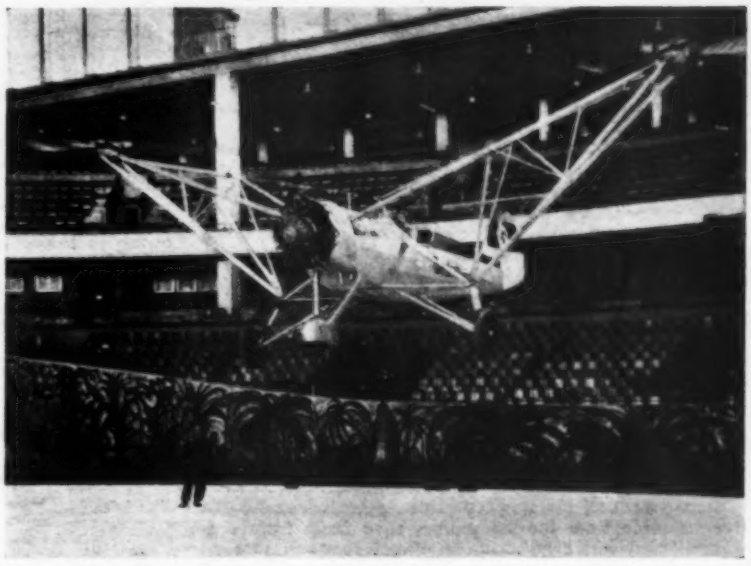
Aircraft, by dropping supplies and by guiding the ice-breakers, played a prominent part in the rescue last week-end of the Russian scientists marooned on an ice-floe in the Greenland Sea.

Five Boeing YB17 four-engined bombers last Friday flew the 2,500 miles between Lima and Buenos Aires in 12½ hours. They had already flown 2,700 miles from Miami to Lima in less than 16 hours.

Lord Dufferin and Ava, Under Secretary of State for the Colonies, is now making a 3,000-mile air tour of British territories in Aden, Somaliland and the Sudan, flying in Service machines, including a Vickers Valentia troop-carrier and a Vickers Vincent.

Lockheeds have lately been developing a new engine installation known as "Unitwin Power." This entails the coupling together of two Menasco engines mounted side by side and driving one airscrew. Either engine may be operated independently of the other.

Northern and Scottish Airways have been performing emergency ambulance duties in the Hebrides again. On the same day, their machines brought to Glasgow for hospital treatment a girl from North Uist with appendicitis and a five-year-old boy from Barra with a broken arm.



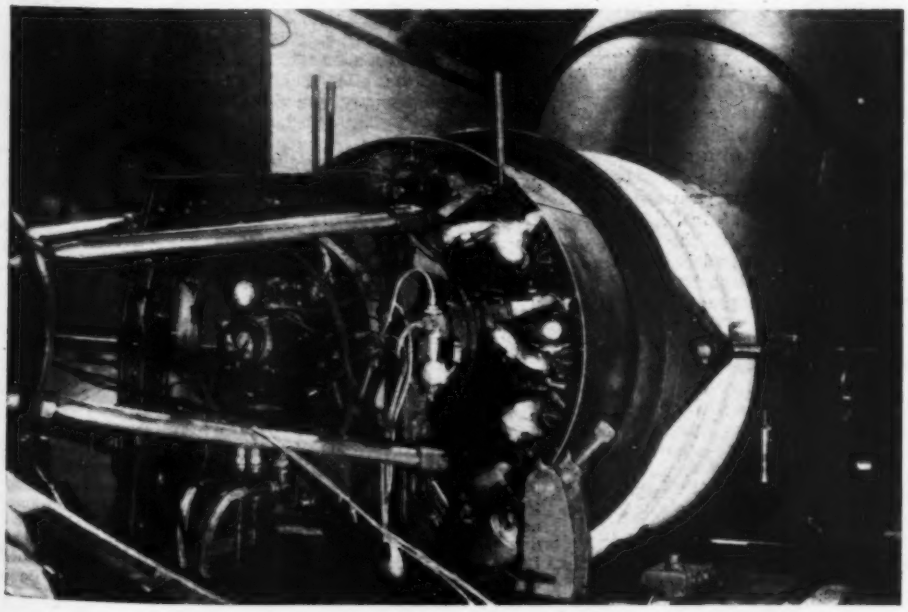
HELICOPTER CONTROLLABILITY: Fräulein Hanna Reitsch making her remarkable indoor flight (reported last week) with the Focke-Wulf helicopter in the Deutschlandhalle, Berlin. Horizontal motion is obtained from the rotors, and not from the airscrew, which acts mainly as a cooling fan.

One of the floats of the *Mercury* was slightly damaged last week when it came in contact with an oil tank set adrift by an exceptionally high tide.

For the fiscal year 1938-39 the Canadian Government has voted $10,753,617 (£2,150,700) for 75 new aircraft, stores, five air bases on the Pacific coast and an additional 480 officers and men for the Royal Canadian Air Force.

The Caproni concern is said to be building a machine to recapture for Italy the world's altitude record. An original type of Isotta Fraschini engine is to be fitted.

The Brazilian Air Force has acquired the three Savoia-Marchetti bombers which recently flew the South Atlantic. The Duce has made Brazil a present of the machine piloted by his son.



PASSED OFF TEST.

The Alvis Pelides engine on test at its makers' works at Coventry. As recorded in *Flight* last week, this engine passed its type tests a short time ago and has received civil-type approval in the "normal" category, sub-divisions (a) to (e), "special" category (f) to (g) and "aerobatic" category (a) to (g). A detailed illustrated description of the Pelides was published in *Flight* of April 15, 1937.

COMMERCIAL AVIATION

THE WEEK AT CROYDON

Over Water : King's English : Manners and Modes : Ice as a Spectacle : Another Balloon

I NOTICE that Mr. de Valera and entourage continue to travel by boat and train, coracle and chariot, or some other outdated means. They take hours and hours and hours (or is it days and days?) to get to London.

Quite a lot of our own politicians sneak away by boat and train when they should save their country's time and money by flying, but you'll notice that the dictators usually seem to fly when they go places. Some of our politicians are not so bad, however, and lately there has been an epidemic of M.P.s flying to Berlin to learn about air-raid precautions.

Reverting to Dublin, air travel "to and from" is on the increase quite amazingly. Next summer, I hear from Capt. Olley, who looks after Irish Sea Airways' interests over here, you will be able to fly from Dublin any day of the week and link up at Croydon with about a hundred Continental cities, as well as with air lines to the Far East.

Ancient superstition says that if you want to be rid of a witch who brings bad luck, cross running water. Capt. Olley, with considerable acumen, has wooed good luck by operating most of his services across water where he can save valuable time for his public, save them from sea-sickness, and where he is not in direct competition with fast train services operating over comparatively short stretches. Where your internal air service competes with the train on a straight run, your handicap is, in nearly every case, at least half an hour between airport and city centre at each end. Olley is not only associated with the Dublin run, but also with the Isle of Man services and the equally popular link between Heston, Croydon, Brighton, across to the Isle of Wight, and thence to Bournemouth, Bristol and Cardiff. In the remoter west there is the Penzance-Scilly Isles service, which, I am told, is full up even in winter time. All these cross-water services show a tremendous saving of time for the traveller. During the summer, I believe, there will also be a direct Heston-Isle of Wight service.

Composition

I often wonder who does the English prose compositions for the Air Ministry. Is it some Litt.D. of Department C.A.3¾ who writes those prose poems, the *Notices to Airmen?* Someone, in the best tradition of Dan Chaucer, Piers Plowman, Wat Tyler, Which Plumber, and other fathers of English literature, is responsible for a gem of British prose on a notice-board just within the airport gates. So much has seldom been said with so glorious a brevity. The whole policy of the authorities is elaborated in a couple of words, and, incidentally, a warning to motorists is also conveyed. The notice reads, "Drive Slow," and I am fiercely in opposition to the school of thought which regards it as too abrupt and holds that it would be more in keeping with the Department's usual chastely diplomatic language if it was rounded off into, "'Ere, drive slow, carnt cher."

Bless my soul, how we live and learn! A newspaper, under the heading "Secret History of the Day," says that Imperial Airways has issued an instruction to its traffic staff, described as "those old-school-tie traffic officers," to which I add, "but not—oh not—with uniform, Horace." The instruction says that persons with baggy pants may be millionaires and are to be addressed as "Sir," and that such terms as "O Kay" and "Okey-Doke" are not to be used. First of all, every passenger, however queer, should obviously be addressed as "Sir" or "Madam," but can no colloquial exception be made when a jolly young Jane addresses a traffic official with "Say, Angel Face can I get a highball on the Parrus ship?" In those circumstances mebbe a guy oughter yell, "Why, sure, honey, that'll be O.K. by us."

A little old lady who was passing by the main hall refreshment bar last week paralysed both staff and customers by producing from her reticule a grimy envelope containing a pinch of special tea and requesting that a brew should be prepared forthwith. Dazed attendants did as bid, and after turning it down once as too weak, and again as too strong, little old lady drank it with large quantities of milk and sugar (on the house) and then, they say, departed without paying. The question of corkage obviously arises here. The whole situation was complicated by the fact that the aforementioned little old lady was accompanied by what seemed to be a wigwam composed of plaid rugs, fancy shawls, scarves and fur coats. Later, owing to heavy breathing through a button-hole, it was found that the perambulating wigwam was a beast of burden in the shape of a very small page boy.

Another little old lady rang up Surrey Flying Services last week to enquire about a 5s. joy-ride, during the really inclement weather, which, incidentally, brought a freighter down with ice formation somewhere in England. She wanted a guarantee that her five bob's worth would include a view of ice forming on the wings. I suppose she visualised really attractive frond-like crystals. Owing to the various up-to-date de- or ant-icing devices or compounds used by Surrey's no guarantee of an aerial ice carnival could be given.

Pastes

About compounds and pastes, I hear that fewer and fewer pilots of all-metal machines pin any faith to them. One extremely experienced pilot told me recently that the only paste he had any use for was bloater. I would not go so far as that myself, for there is a lot to be said for salmon and shrimp.

Another balloon broke loose from Cardington or somewhere last week and made whoopee round the countryside, finally going to roost in a tree. From now on we ought to christen the Balloon Section "Bo Peep's Boys." If they are to be in charge of the balloon barrages and complicated aprons round London we have some fun to look forward to. Heaven aid us when they've just got the whole lot nicely adjusted and some cruising kestrel up there should happen to sneeze.

Talking of cables (but not the sort which balloon people so often fail to hang on to), I see that a cable company has cut its rates for foreign wires and this has been attributed to air mail competition. Whilst I am glad that commercial aviation has obtained cheaper cable rates for the public, I don't see that much will come of the move, for, however cheaply you can cable, you can do a great deal better by means of a long, explicit and very inexpensive air mail letter.

I hardly expect you to believe that the hangar roofs, damaged in an accident as long ago as November of last year, are actually being repaired. Incidentally, they are also being painted the most bilious yellow, which is said to increase their visibility in bad weather. Someone who saw the roofs for the first time in this condition on a Monday morning remarked "It isn't a hangar, old boy, it's a hang-over."

A. VIATOR.

P.S.—Freight from Baghdad to London: One set false teeth for repair, marked "urgent."

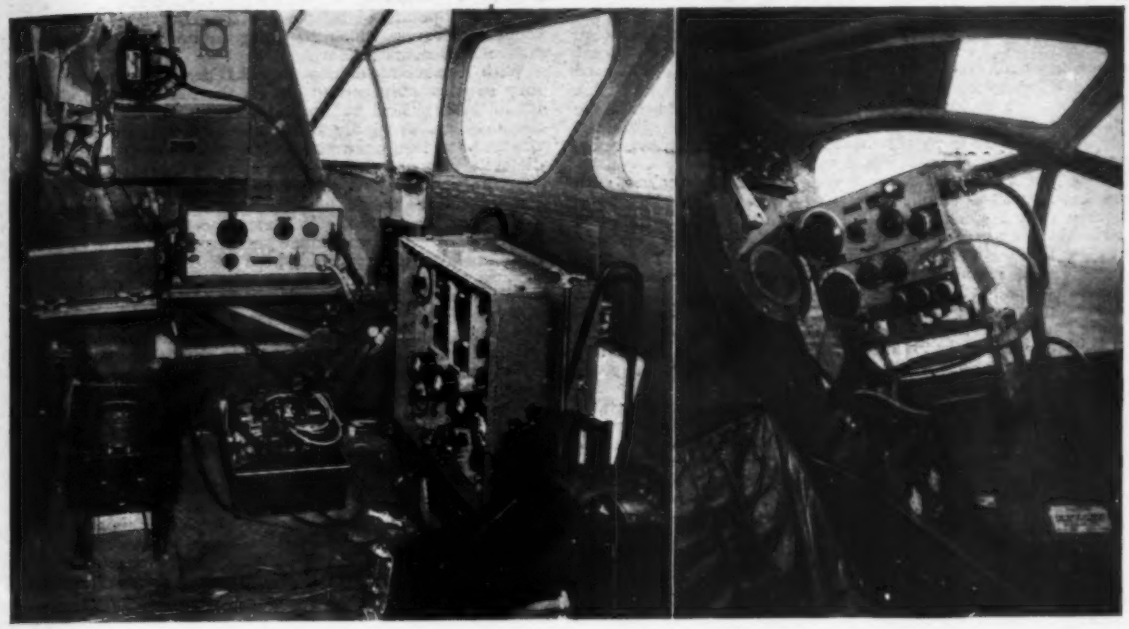
Percival "Q Ships" Sold

AFTER the very successful flights of the prototype and its official approval, work on the production models of the Percival Q-type twin-engined civil aeroplane has been going forward rapidly and the first machines of the batch are now nearing completion at Percival's Luton Airport works. The first production machine has been sold by W. S. Shackleton, Ltd., to Sir Philip Sassoon, and another machine of the batch to Mr. Geoffrey Legge, of H. B. Legge and Sons, Ltd. Both are likely to take delivery very soon.

Commercial Aviation

AUTOMATIC HOMING

Two Navigational Aids—D/F and the Automatic Pilot—Combined for Air Survey : A Development With Great Possibilities.



Two views of the interior of the survey Dragon. The first of them shows the cabin arrangements with the drift sight, linking unit and D/F receiver on the left ; the two axis control unit and short-wave receiver in the centre ; and the transmitter and the camera cradle stabiliser on the right. Through the door beyond the transmitter may be seen the automatic pilot control panel. The picture on the right shows the installation in the pilot's cockpit, with the loop control, direction-finding receiver and charging switchboard. The lateral automatic unit is below the pilot's seat.

ALTHOUGH the idea of linking an automatic pilot with radio D/F equipment is not altogether new—some experiments have already been carried out in America and elsewhere—this country can reasonably take the credit for producing the first combination of this equipment to be used in practical operations.

It was, perhaps, somewhat natural that a survey company—Air Travel and Survey Pty., Ltd., of Sydney—should first take a serious interest in the commercial possibilities of such a development, since survey work involves very accurate flying for long periods if the results are to be really useful. Nevertheless, the idea has far greater possibilities. In the transport world, for instance, the pilot has already been relieved by the automatic pilot of the need for constant course-keeping and bump correction during a long flight, so that he may be free to attend to his navigational problems and so that, incidentally, his nervous energy may be properly conserved for the more difficult business of making the final approach and landing in weather conditions which are often very trying.

There is no reason why this useful relief should not be, to some extent, now extended to the approach itself, the machine being held on its course down an ultra-short wave beam, or other radio guide, with far greater accuracy than would be possible by human endeavour, while the pilot concentrates altogether on his stop-watch, his sensitive altimeter and his air-speed indicator.

The two firms which have recently been working on this interesting combination are Marconi's Wireless Telegraph Co., Ltd., who, of course, carried out the radio work, and P. B. Deviator, Ltd., who supplied and installed the automatic pilot. The initial experimental flying was done by Capt. Philip Bailey, of the P. B. Company, in his Puss Moth, but the equipment is now installed in a D.H. Dragon, which, after final tests, will be flown out by Mr. Macarthur Onslow in easy stages to Australia, where it will be put to work.

The principle behind the operation of the equipment is really quite a simple one, though, as is usually the case, there is a fairly large gap between principle and practice. Briefly, the directional and fore-and-aft unit of the automatic pilot layout is constantly readjusted through electro-magnets by means of the microammeter, used in the ordinary course of events for indication of course changes, while homing on a fixed route. In fact, the equipment will work equally well while flying with the loop in the fore-and-aft plane and the receiver tuned in to a broadcasting or other transmitting station lying to the right or left of the track, though in this case the course which is automatically flown will be in the form of a curve, the radius depending on the distance of the station from the machine.

The idea was particularly applicable to the type of automatic pilot developed by the P.B. Company, since an electro-magnetic form of gyro-precessing control had already been in use for some time. In the case of any machine fitted with this form of automatic pilot a control panel can be arranged so that, by the depression of different press-buttons, electro-magnets radially disposed around a soft-iron armature on the extension of the gyro spindle may be suitably energised. By this means the gyro axis is tilted to provide, through the servo-operating mechanism, the necessary change of course or attitude.

The Linking Method

It was only necessary, therefore, to connect this electrical control in some way with the direction-finding indicator. This indicator is so designed that lag prevents the pointer from following individual pulse changes in the signals, and it simply records an overall change in signal strength. With the loop adjusted at right-angles to the line of flight while the machine is flying toward a transmitting station, deviations to the right or left, with a consequent increase in signal strength, cause the needle to deflect one way or the other. A sensitive moving-coil relay is arranged so that its tongue follows the movements of the needle. On either side of this tongue is a contact connected to two subsidiary relays, either one of which is energised when an off-course reading is registered. These subsidiary relays are also provided with contacts which complete the circuit and suitably energise the gyro's electro-magnets. As the gyro is precessed, valves operate the appropriate servo motor to correct the deviation.

COMMERCIAL AVIATION (CONTINUED)

The Dragon to be used for survey work is fitted with a three-axis automatic control system, though movements in the directional plane are, in this case, the only ones of direct importance. The automatic pilot unit concerned is that controlling both directional and fore-and-aft movements, but the electro-magnets, which are automatically energised from the homing indicator, precess the gyro only to produce directional movement. The other electro-magnets on this gyro and on that concerned with lateral control may be energised in the usual way by means of the press-button controls provided. The lateral unit is, incidentally, arranged conveniently beneath the pilot's seat. Adjustment of the resistance in the electro-magnet circuits is possible so that the rate of turn, and other deviations, may be set for any particular conditions.

Apart from the medium-wave direction-finding receiver, with its hand-operated loop and bearing indicator, the Dragon is equipped with Marconi long- and short-wave transmitters and receivers. According to present plans, when the machine reaches its particular operating area the transmitting equipment will be removed, installed on a lorry with the necessary generators and so forth, and be used for homing purposes along the different strips of country which are being photographically surveyed. This is in the nature of a convenience rather than a necessity, since it would be possible to use any broadcasting stations which are sufficiently far from the scene of operations to ensure reasonably straight courses.

The Marconi Company has produced a form of orientator for use with the equipment, this showing the different courses flown with the transmitting stations in various relations to the machine. When laid out on the ordinary ten-mile-to-the-inch aviation map the particular loop aerial setting to provide the straightest automatic course between two points may be read off at sight. Using Droitwich, for instance, the True loop bearing for a practically straight flight (ignoring drift) between Croydon and Farnborough is 50 deg. Needless to say, a selection of orientators would be necessary for the work on different scales, but if this method of navigation becomes at all usual there should be no difficulty in producing some kind of plotting instrument which may be adjusted for different conditions. In fact, the slight curve may be removed altogether by suitable adjustment during flight, and here one can see a possibility of estimating drift while flying blind, using as "points of reference" the D/F bearings and any changes of course which are being automatically made by the controlled automatic pilot.

With a machine of conventional design course-corrections may be accurately carried out on the rudder alone, while the lateral level is held by the automatic pilot, but some modern machines are so rigidly stable directionally that new difficulties may be met when the system is applied to them. These difficulties are not likely, however, to be insuperable.

Of the photographic survey equipment in the Dragon, mention should be made of the separate single-axis automatic pilot which controls the Williamson camera cradle. Changes of lateral level cause important errors in scale, and this auxiliary pilot is intended to keep the camera in an absolutely vertical position in all circumstances. The movements of the cradle in relation to the machine are reproduced by a secondary cradle carrying a special form of drift sight. This drift sight, which has a single centre line, is used by the navigator (the only member of the crew other than the pilot) to ensure by reference to his own strip maps that the track being followed is that required. The picture which the navigator sees in his drift sight is, in fact, exactly that which is being seen by the camera. Any slight effect of precession of the camera gyro over long periods may be adjusted by button controls beside the drift sight.

The camera itself works quite automatically, and on the bulkhead there is an instrument which not only records the number of pictures taken, but by which this number may be adjusted according to the ground speed of the machine. At the rear of the cabin is a small hold which forms an emergency dark-room so that during exceptionally long periods in the air the negatives may be changed.

Japan Takes Over

PREPARATIONS have recently been started by a newly formed Japanese company to operate the service over the route Shanghai-Haichow-Tientsin-Peking which was formerly served by the China National Aviation Corporation, a Chinese-American company. The route will eventually be extended to Tokyo.

New French Types

LAST week the Air-Couzinet 10 (2 Hispano Suiza 9 V engines of 650 h.p. each), which passed out of the official testing ground at Villacoublay during January credited with a cruising speed of 208 m.p.h. at 74 per cent. power, was taken from Bordeaux to the Air France depot at Toulouse, where it is being prepared for its first commercial flight. Considerable interest centres in the use to which Air France intend to put this fast new airliner.

Meanwhile, too, the first of the three Latécoère 523 flying boats derived from the Air France transatlantic veteran, *Lieutenant de Vaisseau Paris*, made its first flight last week, and the second will fly towards the end of March. These three flying boats are not to be confused with the Latécoère 631, which is an improved transatlantic derivative of the *Paris*. Although derived from a civil aircraft, their future will be as troop carriers, and they will be used in the Naval manœuvres next May.

East and West

AFTER protracted conversations, the Australian Government have now agreed to allow K.N.I.L.M. to extend their services to Sydney, on condition that this is done before July 1, 1938. K.N.I.L.M. have agreed that the service shall be officially opened on this date after a month's trial flights, and have, as already stated, ordered five Lockheed 14s, or Super Electras, for delivery in March.

Another agreement has been reached between Holland and the U.S.A. with regard to the Philippines-Dutch East Indies service, whereby American machines can fly from Manila via Soerabaja to the Batavia terminus, and K.N.I.L.M. can extend their Soerabaja-Tarakan service to Manila.

Under the terms of the recently signed commercial agreement between Holland and Venezuela, trial flights have begun between Curaçao and Coro, in Venezuela. Additional flights are also being made from Willemstad to Coro. At least one of K.L.M.'s Lockheed 14s will go into service in Dutch Guiana.

Through to Singapore

THE all-mail-by-air scheme now applies to the places between this country, India, and Malaya, as well as to those on the South African route. The last surface despatches of first-class mail for these parts was made on Thursday of last week, and now, of course, every letter or postcard will be taken by air in the ordinary course of events. The final section between Singapore and Sydney should be included before the beginning of the summer. Eventually there will be five services to Egypt, four to India, and two to Malaya and Australia.

G.A.P.A.N. Awards

AT a reception held at Londonderry House last Monday evening the Johnston Memorial Trophy was presented to Capt. A. S. Wilcockson for his flights across the Atlantic last summer in the *Caledonia*. Lord Londonderry explained in a few words that the Johnston Memorial Trophy is awarded each year by the Guild of Air Pilots and Navigators for the most meritorious feat of navigation during the year. The navigation of Capt. Wilcockson and his crew on the Atlantic flights last summer was held to merit this year's award. Lady Londonderry presented the trophy to Capt. Wilcockson, and afterwards repeated the presentation very gracefully for the benefit of the film operators. Previous holders of the Johnston Memorial Trophy, it may be recalled, were: 1931-32, Mr. Francis Chichester; 1932, Mr. Bert Hinkler; 1933-34, Mr. J. A. Mollison; 1935-36, Capt. E. W. Percival; 1936-37, Miss Jean Batten.

The trophy presented by Miss Cumberbatch for reliability was awarded this year to the pilots of Olley Air Service, Ltd. Last year, it may be remembered, it went to Imperial Airways, Ltd. The trophy was accepted by Sir Hugo Cunliffe-Owen, who expressed his thanks not only to the Olley pilots but to the ground staff who had made possible the regularity which had been thus recognised.

After the official presentation the company spent a very enjoyable hour or so "talking shop" in the famous reception rooms of Londonderry House. There were many who saw in this renewed close association of aviation with his London home something more than the fact that Lord Londonderry is Master of the G.A.P.A.N. The host of the evening was frequently mentioned, in whispers as became the occasion, of course, as the new Under-Secretary for Civil Aviation, an appointment which, according to rumour, the Cadman Report has recommended.

SERVICE AVIATION

Royal Air Force and Official Announcements: Fleet Air Arm News: Military Aviation Abroad

Fleet Air Arm : Short-service Officers

THE Admiralty has drawn up a scheme for the employment of short-service officers in the Fleet Air Arm. It anticipates that when the transfer of the Fleet Air Arm to Admiralty control has been effected the necessary officers will be provided by the executive officers of the Royal Navy and Royal Marines specialising on air work for a part of their career, and also by officers serving in the Navy on a short-service basis, who will be employed solely on naval air duties. Regulations governing the employment of the short-service officers have been drawn up and will be approved by an Order in Council

Officers of the air branch will be employed on flying duties both at sea and on shore. Their duties will be similar to those of a naval officer in the course of his term with the Fleet Air Arm, and can include the command of Fleet Air Arm units and certain other administrative functions, but not the command of sea-going vessels or duties involving the navigation of such.

The first entry into the new short-service branch will be made in April next. Candidates will have to attend before an Admiralty selection committee for interview and will have to undergo a strict medical examination.

The general conditions for entry into this branch of the Navy are as follows: Candidates must be not less than 17 years six months or more than 23 years of age. They must be British subjects of pure European descent. They must be unmarried. They must have attained a standard of education (including mathematics) equivalent to the school-leaving certificate.

Gentlemen who are accepted for the Air Branch will be required to serve with the Royal Navy for a period of seven years, followed by eight years on an emergency list. The first two years on the active list will be devoted to training, including preliminary naval training, and the officers will be instructed in flying from both shore stations and ships. The remaining five years on the active list will generally be spent in ships of the Fleet, including foreign service.

While on the emergency list, officers will be required to keep themselves in flying practice (at least twelve hours flying a year), and also to undergo periodical naval training either of a fortnight annually or a month biennially, which will take place in H.M. ships or naval establishments. Opportunities for the other flying practice will be arranged at an aerodrome (not necessarily naval) as near as possible to the officers' homes.

At the end of eight years on the emergency list, officers will be transferred to the retired list of the Royal Navy, and will not be required to keep in flying practice or to undergo training; but they will be liable to be called out for service in a war or an emergency.

At the end of seven years on the active list, officers who volunteer for further flying service may be accepted by the Admiralty for eight years more. Of those whose active list service is so extended to a full fifteen years, a few may be allowed to remain for a further period to qualify for retired pay.

Gentlemen who have reached the age of 22 at the time of their entry will be granted the rank of Acting Sub-Lieutenant (A); others will enter as Midshipmen (A). Rules for promotion, pay, gratuities, etc., are published. Briefly, a Midshipman (A) will receive 5s. a day, and a Lieu' nant-Commander, after six years in that rank, will receive £1 10s. 10d. a day.

Additional flying pay will be 4s. a day for Midshipmen (A) and 6s. for others. On first appointment officers will be given an outfit gratuity of £25, and a further £25 on completing the probationary period of one year, or on promotion to Acting Sub-Lieutenant. While on the emergency list, officers who comply with the rules mentioned above will be granted a sum of £25 per annum.

Copies of the regulations and application forms can be obtained from the Secretary of the Admiralty (C.W. Branch/Air), London, S.W.1.

The R.A.F. in Waziristan

THE Commander-in-Chief in India (Gen. Sir Robert Cassels) has issued a report on the Waziristan operations between January 16 and September 15 last year. In it he says that three types of operation were carried out by the Royal Air Force; namely against tribal forces closely and actively engaged with our troops; against hostile fortified villages; and against proscribed areas. In the two latter types ample warning was given on every occasion to enable inhabitants to evacuate the areas before air action was taken.

Continuous pressure of air action by day and night played an important part in obtaining the surrender of the tribes. It secured the surrender of hostages and kidnapped persons, and on occasion the mere threat of such action proved wholly effective.

Columns were invariably accompanied by close-support aircraft, whose co-operation was of the highest tactical value. In addition, bomber transport aircraft were used extensively to transport military personnel and stores and for the evacuation of casualties, thereby saving long and trying journeys by ambulance transport.

The tasks assigned to the air forces entailed very long flights and patrols, often carried out under very trying flying conditions. Eleven thousand hours of operational flying, representing a distance of over one million miles, were carried out, and the negligible number of forced landings which occurred indicates that aircraft maintenance was of a very high order.

The operations marked the first occasion on which a flight of the newly formed Indian Air Force was employed on active service.

R.A.F. Surgeon Murdered in Palestine

SQN. LDR. R. E. ALDERSON, of the Medical Branch, was murdered by Arabs last Friday. He was driving in a taxi on the new Haiffa-Jaffa road with Mrs. Alderson and a friend, Miss Newman, when they were ambushed in a narrow defile. A gang of bandits opened fire at short range and killed the officer. Miss Newman was hit five times but is expected to recover. Mrs. Alderson was slightly hurt, and the taxi-driver, a Jew, was hit in the leg. Mrs. Alderson behaved with great presence of mind. As the taxi-driver had left his seat, she got into the driving seat and drove the taxi to a safe distance. The police arrived within twenty minutes and began to track the gang with dogs.

R.A.F. v. R.N. Flt. Lt. J. S. Wilson, who played for Scotland in 1932, tackled by Lt. N. L. Evans, an English international. F/O. Craven (No. 14) is taking the pass. The fair-haired Navy man behind is Paymr. Lt. J. K. Watkins, the Navy wing forward.

Services Rugby : R.A.F. v. Navy

PRETTY nearly all the prophets expected that the Navy would beat the Air Force in the first match of the Services Rugby tournament at Twickenham last Saturday; and the prophets were right. But they were very nearly wrong. The prophecy ran that the R.A.F. would be better outside the scrum, while the Navy forwards would be superior. This, too, proved right in the long run, but it took a good half of the game before things began to work out as expected. The Air Force forwards went off with such a dash that they nearly let their outsides win the match, and if they could have kept up their superiority in hooking, heeling and rushing the Air Force must have won. In the end the superior weight of the Navy pack wore down C. Beamish and his gallant eight, and then the Navy were able to do what was expected.

From the very start the Air Force got the ball in almost every scrum and heeled smartly. Sowerbutts was on the ball like lightning, and Walker did wonders in running himself and making chances for his threequarters. He is tremendously quick off the mark. The game was only five minutes old when he made a brilliant opening through the centre and sent Craven over in the left corner. The kick was missed. Soon after Walker seemed to get a kick on the head and was laid out for a while. Sowerbutts spared him all he could, but that took a bit of the edge off the Air Force attack. Later on Walker played as brilliantly as ever. The second score was a very good penalty goal kicked by Robinson. Soon after this both Robinson and Thompson had good runs which made a lot of ground.

All this time the Navy seemed paralysed, and when they did get the ball out of the scrums the doughty Vavasour did little with it, while the centre forwards did not seem to know what they were expected to do with a Rugby football. Then, after about forty minutes, the first fine fury of the R.A.F. forwards began to wane, and the Navy began to wake up. Their forwards started to outrush the Air Force, and the threequarters to show signs of initiative and thrust. Suddenly a very pretty piece of passing among the Navy threequarters developed, which ended in Goldsworthy going over near the posts. Crawford, the Scottish international, who had missed two rather long shots at penalty goals, made no mistake in converting the try. The sides changed over with the Air Force leading by one point and the Navy's star in the ascendant. That margin was too slight.

The Navy dominated the game for most of the second half, but the Air Force tackling was as decisive as that of the Navy had been in the first half. Sowerbutts was extremely nippy in getting the ball away from loose scrums, but at this time most of his passes got very wild, and so gave Walker and Robinson no chance to start attacking movements. Now and again Walker would flash through the centre, but no score came from his efforts. For a good fifteen minutes there was little to record except a series of free kicks, mostly against the Navy, which brought relief to the Air Force. But a second really beautiful bout of passing and repassing by the Navy threequarters left all the defence standing and Goldsworthy got a second try which Crawford duly converted.

It then seemed all up with the Air Force, but they ended the game with a furious assault on the Navy lines. A dropped goal would have meant a draw; a converted try would have given the Air Force a win. Either seemed possible, and the last few minutes were wildly exciting. But the Navy defence held and the whistle left them victors by 10 points to six.

TEAMS:

Royal Navy.—Lt. T. G. C. Jameson; Sub.-Lt. W. B. Whitworth, Surg.-Lt. B. M. Goldsworthy, Lt. A. L. S. Hogg, Lt. (E.) J. P. Kirkby; Lt. G. E. Vavasour, Sub.-Lt. D. T. Wickham; Lt. (E.) N. L. Evans, Lt. (E.) D. N. Callaghan, Ldg. Tel. R. G. Stovell, Pay Lt. H. C. Lyddon, A/B. H. Attwood, Sub.-Lt. W. H. Crawford, Lt. R. J. L. Hammond, Pay Lt. J. K. Watkins.

Royal Air Force.—Sgt. I. Parsons (Dishforth); F/O. W. G. Moseby (Abingdon), P/O. S. J. D. Robinson (Martlesham), F/O. J. M. Thompson (North Weald), F/O. D. H. M. Craven (North Coates); Flt. Lt. G. A. Walker (Catfoss), P/O. J. O. Sowerbutts (Netheravon); F/O. R. H. Waterhouse (Upavon), P/O. L. Fox (Calshot), S/Ldr. C. E. St. J. Beamish (Eastchurch), Sgt. R. R. McPherson (Hornchurch), Flt. Lt. J. S. Wilson (Uxbridge), F/O. P. S. Hutchinson (Thornaby), Flt. Lt. C. H. Beamish (Halton), A/C. J. Holland (Hendon).

Commissions for Warrant Officers

THE following Warrant Officers have been granted commissions in the equipment branch:—A. S. Thompson, G. Filmer, G. B. Lewis, A. Hoggar, H. A. May, M.B.E., W. Hodges, W. G. Banfield, A. W. Heath, A. R. Williams.

Imperial Defence College

THE following Dominions officers have completed the course at the Imperial Defence College which ended last December:—Group Capt. F. H. McNamara, V.C., Royal Australian Air Force, and Group Capt. G. O. Johnson, Royal Canadian Air Force.

Annual Dinners

THE seventeenth annual dinner of the R.A.F. Dinner Club will be held at the Connaught Rooms at 7.45 p.m. for 8.15 p.m. on Friday, March 25. The address of the honorary secretary is:—Room 670, Adastral House, Air Ministry, Kingsway, W.C.2.

The nineteenth annual reunion dinner of No. 55 Squadron (R.F.C. and R.A.F.) Association will be held at the Criterion Restaurant, Piccadilly Circus, London, W.1, at 7.30 p.m. for 8 p.m. on Saturday, March 5, the twenty-first anniversary of the squadron's arrival in France on active service. The price of the dinner to members of the Association will be 10s. 6d. each and the charge for guests 12s. 6d. All past members of the squadron who have not received a circular are requested to communicate with the honorary secretary, Captain L. B. Goodyer, 16, The Crossways, Sutton, Surrey.

Royal Air Force Gazette

General Duties Branch

Lt. Cdr. K. Williamson, R.N., is reattached to the R.A.F. as a Flight Lieutenant, with effect from January 3 and with seniority of April 1, 1935.

The following Flying Officers are promoted to the rank of Flight Lieutenant (January 28):—A. R. D. MacDonell, P. D. W. Hackforth, H. D. Beck.

Sqn. Ldr. R. Jope-Slade, O.B.E., D.S.C., is granted the acting rank of Wing Cdr. (paid) (January 28).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—B. J. R. Roberts (January 15); G. W. Peel (January 16); H. M. Starr (January 19); L. R. Stewart (January 27).

Capt. A. R. Burch, R.M., Flt. Lt., R.A.F., ceases to be attached to the R.A.F. on return to duty with the Royal Marines (February 7); Flt. Lt. A. T. H. Willis is transferred to the Reserve, Class A (February 11).

Equipment Branch

F/O. (Acting Flt. Lt.) A. Wall is promoted to the rank of Flight Lieutenant (January 8).

Medical Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant with effect from January 4 and with seniority of the dates stated:—D. F. Cameron, M.B., Ch.B. (January 4, 1937); J. H. Lewis, L.M.S.S.A. (January 4).

Chaplains Branch

The Rev. W. A. Kleinschroth is granted a short-service commission with the relative rank of Squadron Leader with effect from February 1.

Auxiliary Air Force

General Duties Branch

No. 602 (CITY OF GLASGOW) (BOMBER) SQUADRON.—F/O. M. Robinson is promoted to the rank of Flight Lieutenant (February 5).

Equipment Branch

Capt. W. A. M. Hanson, M.C. (R.M. Ret.), is granted a commission as Flight Lieutenant (December 20, 1937); Maj. A. H. Erskine-Lindop, M.C. (I.A. Ret.), relinquishes his commission on cessation of duty (January 18).

SERVICE AVIATION (CONTINUED)

Royal Air Force Appointments

General Duties Branch

Group Captains.—G. B. Dacre, D.S.O., to R.A.F. Station, Thorney Island; to command, 3.2.38. J. H. Herring, D.S.O., M.C., to R.A.F. Station, Stradishall; to command, 3.2.38. R. H. M. S. Saundby, M.C., D.F.C., A.F.C., to Directorate of Operations and Intelligence, Air Ministry; for duty as Deputy Director of Operational Requirements, 18.1.38. C. C. Darley, C.B.E., A.M., to No. 1 (Indian) Group H.Q., Peshawar; to command, 8.1.38. R. D. Oxland, O.B.E., to No. 1 R.A.F. Depot, Uxbridge; attending course at the Imperial Defence College, London, 18.1.38.

Wing Commanders.—C. L. Scott, D.S.C., to No. 209 (G.R.) Squadron, Felixstowe; to command, 29.1.38. E. C. Emmett, M.C., D.F.C., to Electrical and Wireless School, Cranwell; for Administrative duties, 31.1.38. C. Torr-Anderson, to No. 1 A.T.C., Catfoss; to command, 31.1.38. C. W. Busk, M.C., A.F.C., to H.Q., Training Command, Market Drayton; for Armament duties, 18.1.38. J. B. Cole-Hamilton, to Aircraft Depot, Karachi, India; to command, 11.1.38. J. Oliver, A.F.C., to No. 1 (Indian Wing) Station, Kohat, India; to command, 21.12.37. L. H. Cockey, H. W. L. Saunders, M.C., D.F.C., M.M., L. N. Hollinghurst, O.B.E., D.F.C., J. W. Baker, M.C., D.F.C., S. C. Strafford, D.F.C., to No. 1 R.A.F. Depot, Uxbridge; attending course at the Imperial Defence College, London, 18.1.38. R. Halley, D.F.C., A.F.C., to R.A.F. Depot, Uxbridge; attending course at the Royal Naval Staff College, Greenwich, 11.1.38. N. L. Desoer, to No. 1 R.A.F. Depot, Uxbridge; attending course at the Army Staff College, Camberley, 21.1.38.

Squadron Leaders.—E. J. L. Hope, A.F.C., to No. 1 R.A.F. Depot, Uxbridge; attending course at the Royal Naval Staff College, Greenwich, 11.1.38. J. D. I. Hardman, D.F.C., to No. 1 R.A.F. Depot, Uxbridge; attending course at the Army Staff College, Camberley, 21.1.38. A. H. Montgomery, M.B.E., to Directorate of Operations and Intelligence, Air Ministry, vice Sqn. Ldr. (Act. Wing Cdr.) R. Jope-Slade, O.B.E., D.S.C., 28.1.38. R. C. Jonas, to No. 29 (F.) Squadron, Debden; to command, 1.2.38. J. F. F. Pain, to No. 214 (B.) Squadron, Feltwell; for flying duties, 29.1.38. G. H. Loughnan, to No. 5 F.T.S., Sealand; for flying duties, 29.1.38. E. L. S. Ward, to No. 28 (A.C.) Squadron, Ambala, India; to command, 13.1.38. E. A. C. Britton, D.F.C., to Special Duty List; seconded for duty with the British Military Mission, Egypt, 17.1.38. J. C. A. Johnson, to H.Q., R.A.F., Iraq, Dhibban; for duty as Air Liaison Officer, 28.1.38. G. F. Macpherson, to H.Q., R.A.F., Mediterranean, Malta; for Air Staff duties, 24.1.38.

Flight Lieutenants.—G. J. L. Read, to H.Q., R.A.F., India, New Delhi, 28.1.38. L. M. Hooper, to No. 4 F.T.S., Abu Sueir, Egypt, 28.1.38. R. V. McIntyre, to No. 55 (B.) Squadron, Dhibban, Iraq, 28.1.38. H. P. Broad, to No. 4 F.T.S., Abu Sueir, Egypt, 10.1.38. S. E. MacKenzie, to No. 8 F.T.S., Montrose, 26.1.38. R. J. Bennett, to R.A.F. Depot, Middle East, Aboukir, Egypt, 28.1.38. J. J. Murphy, to Aircraft Park, Lahore, India, 28.1.38. R. J. Gosnell, to No. 8 F.T.S., Montrose, 24.1.38. A. H. Seymour-Lucas, to No. 1 (Indian) Group H.Q., Peshawar, 6.1.38. A. F. McKenna, to No. 1 (Indian Wing) Station, Kohat, India, 30.12.37. W. J. Smail, to No. 1 Armoured Car Company, Dhibban, 22.12.37. C. C. House, to No. 2 (Indian Wing) Station, Risalpur, India, 29.12.37.

Equipment Branch

Wing Commander.—W. G. MacD. Nicholl, to H.Q., Coastal Command, Lee-on-the-Solent; for Equipment Staff duties, 7.2.38.

Squadron Leaders.—G. L. Worthington, to H.Q., R.A.F., India, New Delhi; for Equipment Staff duties, 3.1.38. E. A. Burridge, to Equipment Training School, Cranwell, 24.1.38.

Flight Lieutenant.—J. W. Stokes, to H.Q., R.A.F., Iraq, Dhibban, 28.1.38.

Accountant Branch

Squadron Leader.—E. V. Humphrey, to R.A.F. Depot, Middle East, Aboukir, Egypt, 21.1.38.

Flight Lieutenant.—H. A. Frost, to No. 47 (B.) Squadron, Khartoum, 28.1.38.

Medical Branch

Group Captains.—H. A. Hewat, to H.Q., R.A.F., Iraq, Dhibban, for duty as Principal Medical Officer, 28.1.38. F. N. B. Smart, to H.Q., Bomber Command, Uxbridge; for duty as Principal Medical Officer, 1.2.38.

Wing Commander.—J. G. Russell, to Central Medical Establishment, London; for duty as President, No. 2 Medical Board, 2.2.38.

Flight Lieutenant.—G. Gilchrist, to R.A.F. Station, Marham, 2.2.38.

Chaplains Branch

Rev. C. W. A. Noble, to No. 1 R.A.F. Depot, Uxbridge, 18.1.38. Rev. C. E. Warrington, to R.A.F. Station, Halton, 18.1.38.

Owing to the greatly increased length of these lists as a result of R.A.F. expansion, ranks are confined to those of Flight Lieutenant and above.

FOREIGN SERVICE NEWS

Java Aircraft Factory

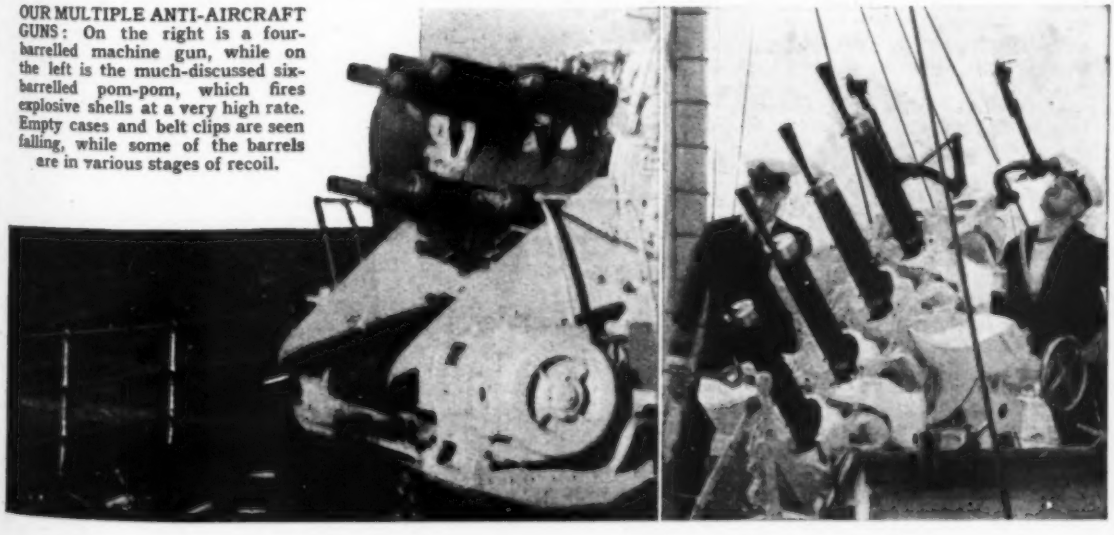
MR. KOOLHOVEN, the well-known Dutch constructor, intends to establish a factory for military aircraft in Java, in the Dutch East Indies.

Bombs in Barcelona

THE Mayor of Barcelona has come to London and has invited a number of M.P.s to visit his city to inspect the results of the bombing. He said that four types of explosive bomb had been dropped, two or three of which weighed half a ton. Bombs dropped recently had gone through six or seven floors before bursting, and had killed people 450 yards away. No wide conflagration had resulted from incendiary bombs. In the past year there had been 23 bombing raids, 528 bombs dropped, 916 deaths, 2,500 wounded, and 863 houses destroyed.

U.S. Fighter Equipment

FIRST deliveries of Seversky P-35 single-seater pursuit monoplanes (Twin Wasp) have been made to Selfridge Field, Michigan. The machines are replacing Consolidated PB-2A two-seaters (Curtiss Conquerer with turbo-blower) and Boeing P-26 single-seaters (Wasp) which are being transferred to other stations. The new Seversky is said to be capable of 340 m.p.h. at 18,000ft.



OUR MULTIPLE ANTI-AIRCRAFT GUNS: On the right is a four-barrelled machine gun, while on the left is the much-discussed six-barrelled pom-pom, which fires explosive shells at a very high rate. Empty cases and belt clips are seen falling, while some of the barrels are in various stages of recoil.

PRIVATE FLYING

Past and Future: A striking impression of the Stearman Hammond and one of K.L.M.'s D.C.2s on the tarmac at Croydon. The Hammond is, of course, being used to accustom the company's pilots to the tricycle technique in preparation for possible operation of Douglas D.C.4s in due course. The Hammond is, however, primarily interesting as a private type—or as the basis of future private types.
(*Flight* photograph.)

Topics of the Day

Comparisons

MOST of us have been involved at one time or another in arguments with ground-loving laymen concerning the relative value (at the present time and in the future) of the aeroplane as a means of private conveyance for the ordinary person, other than one travelling in the scientifically organised transport aeroplane. This argument is usually without possible end, and I often think that the comparisons made by the laymen can be very unfair.

For instance, he may say that a private aeroplane will never be seriously considered by the ordinary person so long as so much experience—and navigational experience in particular—is necessary for its full value to be appreciated. You will be told that it is so easy to find your way while on the ground (signposts and things) and that you can always stop to ask some person if there is any doubt in the matter.

Certainly, it is not usually possible to come down in order to ask anyone to explain the way to such and such a place, but for the life of me I cannot see why it should be necessary to do so. In your car, without a compass and on a road flanked by tall hedgrows, it is possible to lose your sense of direction entirely, but from an aeroplane you can, in almost the worst conditions, see quite a reasonably wide area from which to choose a landmark, and your compass will (or should) tell you in which direction you are travelling.

To the amateur pilots of this generation it is sometimes possible to get lost, but the man who argues about the comparative difficulties of air navigation entirely forgets that we have only been travelling above the earth for a couple of decades and the whole thing still appears a little strange. The schoolboy of fifteen years has probably put in more hours on his bicycle than any of us have in our aeroplanes. By the time he is thirty years of age he has probably motored or cycled for a matter of at least ten thousand hours, and there are very few professional pilots who have done more in the air.

Hedge-hopping

BECAUSE the human race has, since it descended either from the trees or clouds, been forced to creep about the earth, the layman invariably imagines that if only it would be safe to fly everywhere at an altitude of, say, a hundred feet he would have no difficulties. The fact that if he multiplies this height by ten he would be able to see so much more of the landscape is probably realised, but he is not used to seeing objects which are not only foreshortened and of a strange shape, but are also in such small sizes. If he could see the expressions on the pedestrians' faces as he swept up the Great North Road on his way to Plymouth (having taken the wrong turning at Hyde Park Corner) he imagines he would feel so much happier in his insecure position and so much more certain that he could tell whether he was in Huntingdon or Hampshire.

I admit that flying from place to place would be very much better fun if we could always fly at fifty feet, pulling up sharply over the taller trees and chimney-stacks. After the first twenty or thirty hours of our cross-country experience, when the excitement of picking up landmarks as and when they should appear has to some extent died down, I must confess that cross-country flying at a safe two thousand feet can be very boring. That is why I am always keen about navigational devices, which so help to relieve the tedium.

Nevertheless, the word "tedium" might aptly be translated as mental comfort, and one of the most pleasant features of flying as a means of personal transport over long distances is that, at any rate in good weather, there is practically nothing to worry about. You simply work out a few approximate E.T.A.s. for the more useful landmarks on your track and peer out at these times to see if the landmarks have duly cropped up; if they haven't, then there is almost bound to be a large and unmistakably shaped reservoir or a useful railway junction which will enable you to pin-point your position. Once the first ten minutes of the journey have passed by with everything coming up like clockwork, it is hardly possible to be more than five miles out unless a gale springs up from the opposite direction to that at which it was plotted on your C.D.C.

Vertical

THIS passion for low flying brings up the possibilities of the rotating-winged type of machine, which is also imagined, and perhaps rightly, as the only development likely to bring in an era of flying for the many rather than for the few. With a perfected machine on these lines it should certainly be possible to treat every decent-sized field as a prospective landing area and, more important, as a prospective take-off ground.

Much as I (and, for that matter, everyone else) hope that the rotating-winged machine will very shortly reach a really useful state of development, even this excellent device cannot be considered as the answer to every one of our problems. Admittedly, it should be possible to stop almost dead (without actually dying), and this characteristic might be very useful in certain circumstances. The multiplication of possible flying fields, too, would be worth a very great deal. Nevertheless, the traffic question would still be with us, especially where the English climate is concerned. However slowly you may fly and however near to the ground it may be possible to travel without any appreciable danger, the movements of even five thousand privately owned machines would eventually need to be very carefully regulated.

There is nothing terrible or dictatorial about the idea of

PRIVATE FLYING (CONTINUED)

such regulation. In your car you are not permitted to drive at will on the right-hand side of the road, to hurry furiously up one-way streets against a clear sign of prohibition, nor to belt across traffic lights when these are coloured red. At the present time the amateur pilot probably has more freedom to break his own and other people's necks than any other member of the community, and in due course this freedom for the individual must be modified in order that the freedom of the community may be preserved. Very platitudinous but none the less true.

The new directional control system is an example, if a rather complicated one, of the sort of thing which might be developed. We shall probably be given the lower side of the sky, leaving the upper levels for transport aeroplanes and others, but in our lower levels separate layers will also be marked out for travel on predetermined courses. In this way we should at least be saved from the obvious possibility of head-on collisions. Watch would still have to be kept, especially in conditions of bad visibility, for machines which were being brought down through one's particular level to a landing (or because the upstairs was getting a little too sticky)—just as, when driving your car, you must be ready to avoid other cars which are turning into or out of the main road on which you may be travelling at comparatively high speed.

It is at least unlikely that there will ever be even half as many aeroplane owners as there are car owners, and the aeroplanes have, too, a three-dimensional space in which to move. With careful regulation the chance of collision should always remain as a remote one, which is taken in the same spirit as that, for instance, of being run over by a bus or of falling down stairs. People who become unduly excited about the dangers of this or that tend to forget that the whole civilised community is at present sitting on as large a dump of dynamite as was ever planted. Individuals busy themselves in an endeavour to avoid little risks, but are absurdly complacent about the only danger of any real importance. INDICATOR.

FROM the CLUBS and SCHOOLS

LONDON

EVEN the London Aeroplane Club necessarily felt a drop in flying hours with the prevailing high winds, and only 18 hr. 35 min. was spent in the air. New members include Messrs. N. Shelley, I. Spittle, and the Hon. J. V. Cave.

REDHILL

Bad weather again curtailed flying, but the Puss Moth did a cross-country flight to Torquay. Six new members have joined.

SOUTH COAST

Flying during the week ended February 12 totalled 22 hours, and Mr. V. H. Munzing obtained his "A" licence. An informal dance was held last Saturday.

NEWCASTLE

Flying times last week totalled 45 hr. 50 min., a figure which included 15 hours' dual and a cross-country flight to Croydon. A tramp party will be held in the clubhouse on Friday, February 25. Two new members joined.

BORDER

Cross-country flights were made to Leuchars, Montrose, Newcastle, and Kelso, and flying times up to and including February 18 showed a total of 36 hr. 20 min. Mr. H. Livingstone-Bussell made a successful first solo.

HANWORTH

A flight of club aircraft intends to visit Brooklands aerodrome next Sunday for the first luncheon visit of the season. Mr. Platts has completed "A" licence tests, and the flying for last week totalled 26 hours.

C.A.S.C.

The Corps annual dance was held last Thursday at the First Avenue Restaurant, Holborn, and nearly three hundred members and friends were present. On Sunday four members flew a total of 2 hr. 35 min. at Cambridge

MARSHALL'S

During the week ended February 20, Marshall's Flying School put in a total of 135 hr. 35 min. at the Cambridge aerodrome. Mr. McGoun made his first solo flight, and trips were made to Hatfield and Shoreham during the week.

READING

In spite of the generally prevailing high winds, quite a fair amount of flying was carried out last week by the Reading Aero Club. Mr. Allen has qualified for his "A" licence, and Messrs. Flower and Baillie have joined the club.

CINQUE PORTS

During a week of high winds and snow the flying times at Lympne have naturally suffered, the total for last week being 12 hours. Mr. and Mrs. W. E. Davis are expected back at the end of this week, and in the meantime Mr. David Llewellyn, the chief instructor, has been away doing his Reserve training. On Tuesday a newsreel cameraman was flown around the local countryside in a club machine. Among the visitors was Mr. von Bahr, who called in with an autogiro on his way home to Sweden.

RAND

Improvements and alterations are being made to the new premises, and it was anticipated that occupation would be possible by the end of February. In addition, two Tiger Moths are due for delivery, bringing the fleet total up to eleven. Mr. G. Walmsley obtained his "A" licence, and the flying for January totalled 304 hr. 35 min. In the gliding section it is intended to hold a four-day camp at Easter from Friday, April 15, to Monday, April 18, for members and any others who may wish to attend. The inclusive cost will be approximately £2.

BARTON (BEDS)

Although little activity in the air was shown last week by the members of the Bedford School of Flying, owing to snow and other bad weather conditions, an ever-increasing membership list shows no lack of enthusiasm. Last week six new flying members were enrolled.

STRATHTAY

Another breakdown in the weather coincided with the completion of the redecoration of the club lounge, and if flying was held up by high winds and only seven hours were recorded, there were at least compensations. New members continue to join, and Messrs. M. E. H. Burnett and G. C. Hardy are the latest.

BROOKLANDS

Two interesting demonstrations were made on Sunday, when the Chilton monoplane, flown by its co-designer, the Hon. A. W. Dalrymple, and the Wicko mounting Mr. G. N. Wikner, dropped in at Brooklands, and members were given an opportunity of trying out these new types. Flying was rather handicapped during the week, but the week-end compensated for that. Mr. Macpherson obtained his "A" licence, and Mr. Wenckebach, of Holland, made a first solo. Mr E. Sellon has become a new "oldest" flying member at the age of sixty-one, and Major Maude-Thompson (aged sixty), who held that position, now takes second place.

New Zealand Straights

SOMETHING like a record in the number of hours flown by an individual club machine is the 700 hours put in by the Canterbury Aero Club's Miles Whitney Straight in New Zealand during the first nine months of its life out there. Another New Zealand club, that at Wellington, has also used a similar machine for the last six months, and during this period it has flown well over 500 hours.

Glide Control

ALTHOUGH the development of the new Miles private-owner type, to be known as the Monarch, has been something of an open secret during the last few months, casual reference to one of its features in the firm's house magazine leaves us at least free to say as much as is said there.

The Monarch, which should be out on demonstration next month, is a two-three-seater cabin machine on generally familiar Miles lines, but it has one particularly interesting feature—glide control. In other words, the new flaps on the Monarch can safely be used to stretch or to shorten the approach. So for 1938 we should see at least one long-demanded ideal in a production machine.

Feltham Fiesta

LAST Friday evening the London Air Park Flying Club held a carnival dance, at the Hanworth Park Hotel, which deserved to be better attended than it was, even though there were said to have been 150-odd people there. Miss Jill Wyndham acted as hostess.

The opportunity was also seized for launching a new club magazine, wherein are set forth the advantages—including dual instruction at 30s. an hour—which Hanworth offers.

For the benefit of the geographically uninitiated, it may be added that the official designation of Hanworth Aerodrome is The London Air Park, Feltham, Middlesex.

All sorts of things from landing lamps to electric tools are to be seen in the Lucas exhibit ; it includes the firm's Rotax section, with which the aircraft industry is especially concerned.

AT thB

Points of Interest Gleaned D... Exhibits at Castle Broma... Accessories Manufact...

IN the following pages will be found notes on fifty-odd displays at the Birmingham section of the B.I.F. by firms having considerable connection with the aeronautical industry.

Since, in many cases, exhibits of aeronautical interest form only a very small proportion of the displays, and since we have reviewed the products of the majority of the firms in recent special numbers, this report consists mainly of notes on points which interested *Flight* representatives during a tour of the twelve-mile "shop frontage" at Castle Bromwich last week-end.

Next week it is hoped to deal with some additional exhibits at Birmingham, and also with some of those in the London section of the Fair.

Both sections remain open until Friday, March 4.

Aero Research, Ltd., Duxford, Cambs (B.233).—Protagonists of wooden or plastic construction lay a short course for the Aero Research display which features prominently the Aerolite Synthetic glue for aeronautical use. Aerolite is used on the D.H. Albatross (which is sufficient indication of its quality), and is admirably suited to airscrew production.

Particular care was taken in its development to eliminate brittleness and one gathers that it is possible to bounce a mass of the glue on the floor without it disintegrating. Immunity from attacks by fungus or mould (which, incidentally, are not common to the tropics) is another selling point.

Aerofilms, Ltd., Beresford Avenue, Wembley, Middlesex (B.712).—Industry from the air is the theme of the superb Aerofilms show. "Aerials" of factories, docks, estates, etc., can be of almost inestimable value not only in planning, but for publicity. In some instances, as exemplified by a fine shot of a seed farm, such pictures gain a good deal from judicious colouring. "Brum" folk will be intrigued by oblique views of their city.

Accles and Pollock, Ltd., Oldbury, Birmingham (D.611, 510).—As the uses of drawn tubing are so widespread and A. and P. are said to be the world's biggest producers, we must unconsciously owe an almost daily debt to the firm. More often than not, metal-framed seats in public vehicles, shops, hotels and elsewhere have their origin, so far as material in concerned, in the A. and P. factory.

Not only human beings, but many engines and aircraft owe their support to A. and P. tubing, which is used for engine mountings, undercarriage legs and metal airframe construction generally.

Edgar Allen and Co., Ltd., Imperial Steel Works, Sheffield, 9 (D. 719).—The connoisseur will soon become engrossed in the very latest thing in hand-screwing tools which reposes among a mass of well-proven devices and steels on the Edgar Allen stand. Though fast in operation this new offering is extremely accurate and boasts micrometer adjustment of dies to 0.001in.

There is only one moving part and it is possible to release the holder from the body and to change the dies in less than a minute.

The Anglo-American Oil Co., Ltd., 36 Queen Anne's Gate, London, S.W.1 (D.306).—The merit of petroleum products are not easily displayed for public assessment, but Anglo-American can always be counted on to present their wares conveniently and attractively. Occupants of D.306 economise in words when dispensing advice on keeping cylinder wear low; they just say "Use Esso-lube."

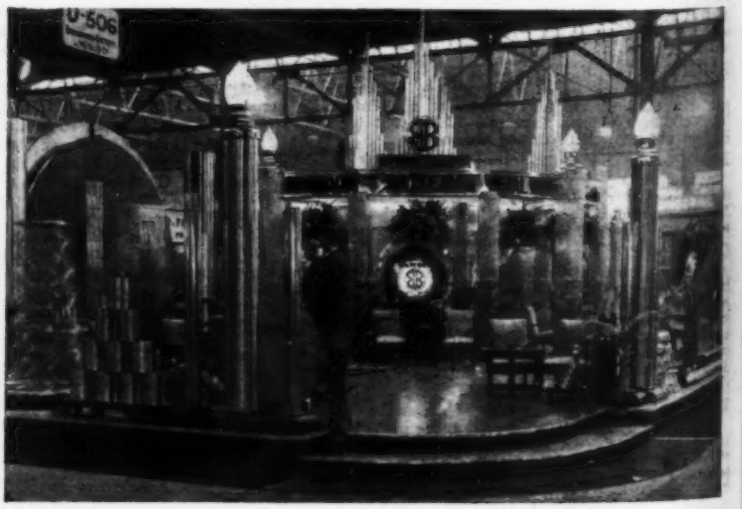
Arens Controls, Ltd., East Croydon, Surrey (D.736).—In our earliest days, if we had been able to apply push or pull efficiently at points well out of our reach, this power used for good or bad would have enabled much more to be done; and although the days of desire for the jam tart on the top shelf may be past so far as their customers are concerned, Arens Controls can solve any remote movement problem by means of rigid or flexible transmitters of push and pull types. Perhaps a high window or ventilator needs opening; what better than an Arens control?

More important, from our point of view, is the application demonstrated by a model aeroplane with joy stick and rudder bar operating ailerons, elevators and rudder through Arens aircraft controls.

Association of Drop Forgers and Stampers, 45, Newhall Street, Birmingham, 3 (D. 418).—Macro specimens in this collective exhibit demonstrate how the grain flow in a forging follows the contours of the metal, making for extreme strength and greater impact values than can be obtained, it is claimed, in a casting.

Members of the Association "smack out" everything from airscrews and crankcases to small brackets.

The Automotive Engineering Co., Ltd., 104, The Green, Twickenham, Middlesex (D.205).—Collets and feed fingers for the most fastidious machine tools represent a big proportion of Automotive Engineering's output. These are made under an agreement with two



The Birmingham Battery and Metal Co. specialises in the working of brass, copper, phosphor bronze and other alloys.

th B.I.F.

leaned D ur of the Twelve Miles of Bromu nautical Components and Manufac Represented

Light, bright and colourful—Cellon show what they have to offer in the way of finishes.

American concerns. Circlips for gudgeon-pin location and other purposes are other items made in vast quantities.

*B.E.N. Patents, Ltd., Gorst Road, Park Royal, London, N.W.*10 (B.629).—Seekers after aerodrome equipment are liable to be confronted on B.629 with an *embarras de richesse*, there being air compressors, receivers, fittings, automatic switchgear, paint spraying machines, spray guns, air filters, valves, hose, exhaust fans and kindred gear making for efficient production methods and workmanship.

Just to top off the show, B.E.N. present power greasers, meters and polishers.

*Bakelite, Ltd., 68, Victoria Street, London, S.W.*1 (Cb.408).—The aircraft industry can never know too much about the application of Bakelite synthetic resin products which is in some measure an explanation of the purposeful trek towards Cb.408. The keen student of Bakelite developments is, of course, aware of the use of Bakelite for instrument panels, cases and similar items, though even he may not be aware of the fact that Teleflex controls employ this ubiquitous material very extensively.

At the moment Bakelite, Ltd., are co-operating with De Havillands in producing some advanced forms of airscrew blades.

Baldwins, Ltd. (Midland Branch), Wilden Ironworks, Stourport-on-Severn (Cb.312).—Very heavily coated tin sheet is the common material used for aircraft fuel tanks. Baldwins supply it, and, moreover, with their Ternecoated sheets, cater for less exacting demands. Ternecoating, may we explain, entails the mixture of lead and tin.

The Wilden Ironworks are also responsible for steel sheets (to A.M. specifications) for aircraft pressings.

Bendix, Ltd., Tyseley, Birmingham, 11 (D.428).—Bendix brakes are justly famed, and it is worthy of note that the Air Ministry have recently placed a big order for such brakes on Tasker trailers.

There is, however, another product which bears the name of Bendix, namely, the Tracta constant-velocity universal joint. This joint, it is claimed, operates with accuracy and efficiency, is compact and has high angularity and a heavy load capacity.

Sizes vary from models suitable for remote controls up to joints for large driving shafts.

Birmingham Battery and Metal Co., Ltd., Selly Oak, Birmingham (Cb. 613).—More than a century ago the founders of this firm established a business for the manufacture of brass pans. The process used employed a battery of tilt hammers, hence the "Battery" in the name of a firm quite unconnected with electrical storage.

To-day all types of brass and copper pipes and phosphor-bronze and aluminium-bronze bearing metals are supplied for aircraft applications.

Ingots unlimited—on the stand of T. J. Priestman, Ltd., specialists in aluminium, brass, bronze and other alloys.

Birmingham Electric Furnaces, Ltd., Birlec Works, Tyburn Road, Erdington, Birmingham (Cb.313 and 214).—Definitely something really patrician among furnaces is the Birlec continuous belt conveyor model, which has taken possession of one side of the double stand. Its mission in life is brazing and bright annealing with controlled atmosphere produced in an I.C.I. patented regenerative ammonia burner.

Blackburn Aircraft, Ltd. (Cirrus Engine Section), Brough, East Yorks (D.729).—The many lively light aircraft which now take the air at home and particularly abroad under Minor or Major power prove beyond doubt the reliability and increased performance of these two popular Cirrus units.

Even if the outside paint and polish of the B.I.F. Show model 90 h.p. Minor and Major 150 is not to be found on a production engine, we can rest assured that all the internal finish and, no doubt, plenty more, is there beneath the more sombre exterior coat.

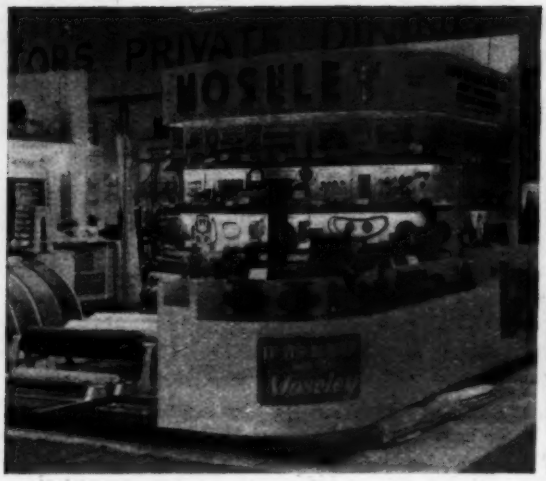
*The British Oxygen Co., Ltd., Thames House, Millbank, London, S.W.*1 (D.411 and 312).—No matter how rough the weather, dissolved acetylene flarelights, as shown by the British Oxygen Co., give up to 10,000 candle-power. They are, in fact, as efficacious in dispersing gloom as are the B.O.C. demonstrators of portable welding outfits in dispelling any doubts on the efficiency of the equipment.

Exhibits centre round oxy-acetylene welding and cutting equipment, and include a range of blow-pipes for brazing and lead-burning.

The British Thermostat Co., Ltd., Windmill Road, Sunbury-on-Thames, Middlesex (Cb.700).—Keeping a tag on Mr. Therm in his diverse duties is a matter calling for some ingenuity, but any tendency on the part of that beneficent personality toward over-exuberance or lethargy is summarily counteracted by devices such as are displayed on Cb.700.

Technicians will appreciate the presence of a valve operated by hydraulic pressure developed by a motor-driven pump. A thermostat automatically regulates the pressure leak between the pump delivery and inlet so that operation pressure, and, therefore, the opening of the valve, is related to temperature.

*British Thomson-Houston Co., Ltd., Aldwych, London, W.C.*2 (Cb.507, 404).—There are surprises here for those who



(Left) Endless variety by David Moseley and Sons, Ltd. (Right) Simmonds Aerocessories, with controls in the foreground and a gigantic "stop-nut" overhead.

imagine that all lamps are produced to give light.

Among the special lighting equipment marketed by B.T.H. are Mercra lamps filtered to give out only the invisible ultra-violet rays, and also fluorescent lamps with outer jackets to correct the normal mercury light emitted. Mazda is now a household name, and this, elevated to the impressive name of Mazdalux, stands for floodlight projectors as made by B.T.H. for aerodrome and other uses.

*Cable Makers' Association, High Holborn, London, W.C.*1 (Cb.401, 300).—The name indicates the purpose of the Association, but the exhibits, revealing the most interesting recent research work of the members, gives an insight into the more intimate activities of the various cable makers. Among them, well known to the aircraft industry, are British Insulated Cables; Callender's; Henley's; and Standard Telephones and Cables.

The Cedos Engineering Co. (E. Martin (Engineers), Ltd.), St. James's Road, Northampton (D.425).—The Short Empire boat and Singapore, the Bristol Bombay and the De Havilland Don are but four of quite a galaxy of aircraft types wherein some Cedos product or other may be discovered. Sheet metal work and fittings are the main "lines" in the company's aircraft business. Aero engine firms are also supplied.

*Cellactite and British Uralite, Ltd., 296-302, High Holborn, London, W.C.*1 (B.522 and 625).—Diatomaceous earth, we learn from C and B.U., is the fossil remains of plants. Furthermore, it is a constituent (with asbestos) of Kimoloboard, a new product adopted for a bomb and gas-proof shelter which can be built in the back garden for £200.

The Kimoloboard (we must learn to dissociate the name from négligée and parlour games) lines a steel chamber and absorbs not only moisture, but exhalations, keeping the air "clean" for many hours.

Cellon, Ltd., Kingston-on-Thames, Surrey (B.529).—The days of bamboo construction are past, perhaps the days of fabric are numbered, but the age of attractive aerodrome buildings has only just commenced.

For wood, leather, or metal a Cerric cellulose finish is ready, and a bright Cerrux hue or Cerrex base prepared. The stand prompts the thought that the Northern Lights, fearing Cellon competition, put their show on first.

Those who would take a closer look at Cellon need not crane their necks; details of experiments are reproduced in photographs larger than themselves, and a stop-watch resembles a town clock in size.

Chance Brothers and Co., Ltd., Firhill, Glasgow, N.W. (D.329).—No fakir-like qualities are required in any one who feels inclined to lie on bits of glass that have passed through the hands of Chance Bros. Though produced for sound and heat insulation, the glass and silk wool "spun" by this firm can also be used for curtains and coverings, while even dust particles in the air can be separated by a glass wool conditioning filter.

Chloride Electrical Storage Co., Ltd. (The), Clifton Junction, Manchester (Cb.307).—Among the innumerable oft-expressed "ifs" is "if only we could harness and store the electrical energy of lightning." Perhaps one day someone will succeed, and in the meantime the Exide people are content to store energy

The Cirrus Minor engine is to be seen on the Blackburn stand. Mr. J. Gadd, of the Cirrus division, is seen on the right.

from, and for, a large number of other sources and destinations; to quote a few—stationary installations, traction, lighting, starting, radio.

We know that uncontrolled power is as useless as (and more dangerous than) no power at all, so among Chloride interests we find switch-tripping equipment and provisions for emergency lighting.

To submerge both battery and bulb in water and leave them to aid in the stand lighting is a small matter for the Chloride Company.

Constructors, Ltd., Erdington, Birmingham (Cb.607, 506).—Considering the number of aircraft and engine parts that must be inspected, classified, and stored, the number of material specifications which exist and the amount of clerical and drawing office work involved, there must be more need, relatively, for filing cabinets, shelves, storage racks, etc., in the aircraft industry than in any other.

There should, however, be equipment to suit every requirement among Constructors' products—even out of doors, when it comes to the storage of workers' cycles.

*Desoutter Bros., Ltd., Hendon, London, N.W.*9 (Cb.213, 118).—It is no longer necessary to connect the name of Desoutter with drills, either pneumatic or electric; the two are practically synonymous. In the design of certain new tools for sheet-metal work the Desoutter tradition should ensure something of exceptional efficiency.

A demonstration by W. and T. Avery, Ltd., shows modern methods in their Birmingham factory, using Desoutter tools.

Dunlop Rubber Co., Ltd., Fort Dunlop, Erdington, Birmingham.—Dunlop aircraft wheels, brakes and tyres, together with such items as gun control gear, are too well known to need introduction. No display of aeronautical accessories appears at Birmingham, though upholstery suitable for aircraft is to be found at Dunlop exhibit in the London Section of the B.I.F.

Esavian Doors, Stevenage, Herts (D.-Outdoor).—There is an undeniable fascination in watching vast doors opening and closing, seemingly without effort but an almost incredible amount of research work is required in connection with such problems as motive power and lubrication.

Years of association have given the Esavian people complete mastery over doors of appalling proportions. They make less fuss over opening a 200ft. expanse than is occasioned by many a garden gate.

Felco Hoists, Ltd., 17, Victoria Street, Westminster, London, S.W.1 (D.103).—Felco lifting appliances are notable for their uncompromising power and relatively small dimensions. They should find plenty of applications in any works. Their pedigree shows a complete absence of castings which, it is claimed, makes not only for strength, but for lightness.

Firth, Thos., and John Brown, Ltd., Sheffield (D.619).—Firth-Brown have every reason to be proud of their connection with the more recent engineering wonders. To mention a few examples: The *Queen Mary* is constructed throughout with F.-B. steels, and large portions of F.-B. metal went toward the making of Capt. George Eyston's *Thunderbolt*, and also the L.N.E.R. *Silver Jubilee* streamlined locomotive. By no means forgotten is the Supermarine Schneider Trophy seaplane with Rolls-Royce R engine in which F.-B. steels figured.

Completed only a week ago, a new Firth-Brown hardness-testing machine gives a variable load from 2 to 30 kilograms, and readings are in diamond hardness. The hardness of very thin sections can be measured with its aid.

Fletcher Miller, Ltd., Dukinfield, Manchester (D.208).—There is a brand of Fletcher Miller cutting oil for every machining operation, and although the term "straight cutting oil" has no bearing on the type of cut, it is probable that a very different quality cut would result was the oil absent. Many an aero cylinder fin has taken shape under a spray of milky F.-M. cutting oil.

Fox, Samuel, and Co., Ltd. (*United Steel Companies, Ltd.*), *Stocksbridge, Sheffield* (D.613, 512).—Specially prepared for highly stressed moving parts, as in aero engines, inspected "Diamet" electric steels are widely used for such components.

Alloy and special steels are the forté of Samuel Fox who, at Stocksbridge, have a steel laboratory that rivals any in the world. Silver Fox stainless steels have a daily increasing market.

Recently type-tested, an Alvis two-row, fourteen-cylinder, Pelides engine occupies a corner of the Fox stand.

Firth-Vickers Stainless Steels, Ltd., "Staybrite" Works, Sheffield (D.413 and 314).—Exhaust manifolds present a particularly ticklish problem to the metallurgists, being exposed not only to very severe heat but to the weather on the outside. Firth-Vickers heat-resisting steels are intended to meet their particular requirements. Exhaust valves, too, are catered for. These components have a rough time of it in the modern high-duty engine.

Yachtsmen and flying-boat operators alike profit from the use of Staybrite steel for wire rope and fittings, as represented in the Firth-Vickers exhibit. The other multitudinous applications of Firth-Vickers steel are too well known to need mention.

General Electric Co., Ltd., Kingsway, London, W.C.2 (Cb.517, 414).—All readers of *Flight* whose daily business concerns them with such things know how often and how vitally the name of G.E.C. is linked with such things as aerodrome lighting (floodlights, beacons, obstruction lights, etc.), works lighting (now particularly valued in the aircraft industry by reason of the G.E.C. Osira mercury-vapour lamps), and electrical equipment—furnaces, motors, etc.—of all kinds for factories and workshops.

It is, then, a revelation to see this B.I.F. exhibit and realise, perhaps for the first time, the almost limitless scope of this concern in other fields, such as those of domestic electricity and decorative lighting. The visitor comes away even more aware of the accumulated background of general experience which lies behind the specialised knowledge in the manufacture of G.E.C. products for the aircraft industry.

Gilman, F. (B.S.T.), Ltd., Smethwick, Birmingham (Cb.516).—Difficulties only exist to be overcome, and Gilman's time is devoted to getting round anything. With the use of the special flexible drive various types of which are ready for examination at Birmingham, grinding, drilling, and polishing operations all become simplified.

The driving motor can be placed or hung out of the way and the power conveniently relayed to where it is required.

Gilman's, incidentally, are the first and only British firm to produce rotary milling shapes.

How to compress air and, having compressed it, turn it to good and profitable use; the B.E.N. Patents display.

"Uncommon" alloys form the bulk of the I.C.I. metals exhibit.

Guest, Keen and Nettlefolds, Ltd., Smethwick, Birmingham (B.524).—Screw eyes, rods, wire, thumbscrews, clout pipes . . . not a list of stores for Spanish Inquisition, but just a few of thousands of small parts that are everyday requirements in aircraft, railways, cars, and ships, in factories and hotels and in parks, fields, and gardens. Guest, Keen and Nettlefold, primarily famed as makers of wood screws, know all about them.

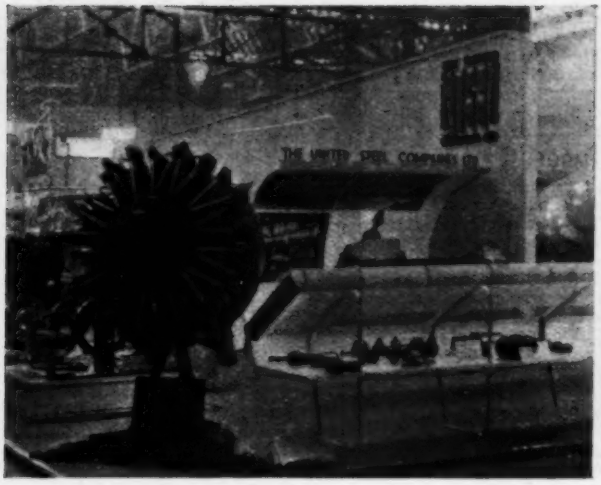
Particularly interesting for aircraft industry is a hardened self-tapping screw; inserted in an untapped hole in metal, it cuts its own thread, as does a wood screw in wood.

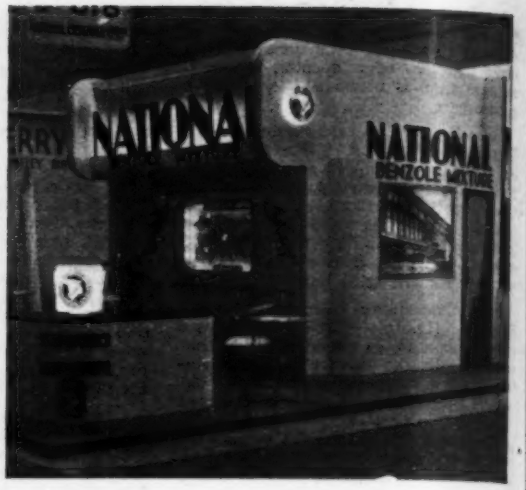
M.C.L. and Repetition, Ltd., Pool Lane, Langley, nr. Birmingham (D.406).—Allowances for forced, driving, push and running fits are all matters of moment in the M.C.L. and Repetition organisation, but Stand D.406 is becoming associated also with fits of laughter at the incredibly clever "zoo" of model animals composed entirely of the firm's products. The fantastic shapes of many of the repetition parts for which the company is famed throughout the industry lend themselves to the most delightful anatomical compositions.

Arrays of nuts, bolts and screws are by no means the easiest exhibits to "put over," but some genius has made this stand one of the most attractive in the whole B.I.F.

National Benzole Co., Ltd., Wellington House, Buckingham Gate, London, S.W.1 (D.618).—People nowadays, according to the cynics, want to be amused, not instructed. If they go along to the "Nat. Benz." stronghold they will (if they are not hardened show- and fair-goers) be intensely fascinated and simultaneously educated by the display demonstrating the production of National Benzole spirit from British coal. The embryonic spirit, after the carbonising of the coal, goes round and round and comes out (just like the music) at the end of a sequence of refining processes.

I.C.I. Metals, Ltd., Witton, Birmingham (D.403, 302).—The aircraft metals supplied by I.C.I. mainly consist of the less common alloys, e.g., brass, cupronickel and phosphor-bronze are produced, together with Everdur and other non-ferrous alloys. The variety of sales is not limited to form only (i.e., tube, wire, rod, extruded sections or sheets), but also covers properties such as temper, finish, etc.





(Left) An Alvis Pelides engine was among the exhibits demonstrating the uses of the United Steel Companies' products. (Right) Telling the story of National Benzole.

Imperial Chemical Industries, Ltd. (Degreasing), Imperial Chemical House, Millbank, London, S.W.1 (D.305).—Oil, grease, swarf and polishing compounds disperse as at the wave of a magic wand when an I.C.I. degreasing plant is switched into life, paving the way for enamelling electroplating, painting, lacquering, rust-proofing or overhaul.

The most recent departures in degreasing technique are represented on D.305. Blackburn, Fairey and Handley-Page are satisfied users of I.C.I. equipment.

Imperial Chemical Industries, Ltd. (Heat Treatment), I.C.I. House, Millbank, London, S.W.1 (D.206).—Such illustrious names as Bristol, Hawker, Fairey, De Havilland, Westland, Airspeed, Napier, Phillips and Powis and Parnall are on the I.C.I. scroll as users of the "Cassel" heat treatment process.

Case-hardening, as perfected by the Cassel Cyanide Co., Ltd. (a subsidiary of I.C.I.), gives steel prolonged resistance to abrasion and shock. The process, of course, increases the carbon content of the surface layers of the steel, leaving the core in its original soft, tough condition. "Cassel" salt baths are, if anything, even more commonly used than the heat treatment processes.

Incandescent Heat Co., Ltd., Smethwick, Birmingham (D.603, 502).—This firm can arrange to give anything a suitably hot time; general heat treatment furnaces are found in several forms, while for the aircraft industry Metalectric alloy crucible furnaces and recirculated atmosphere tempering equipment are specialities.

Gas-fired furnaces for light metals and furnaces for all classes of annealing, hardening, carburising, etc., may be seen under the name of Incandescent Heat or the associated companies, Controlled Heat and Air, Selas Gas, and Metalectric Furnaces.

London Aluminium Co., Ltd., Westwood Road, Witton Road, Birmingham (A.411 and 310).—Spinnings and pressings in aluminium and alloys are the main items calculated to interest the aircraft industry in the London Aluminium display.

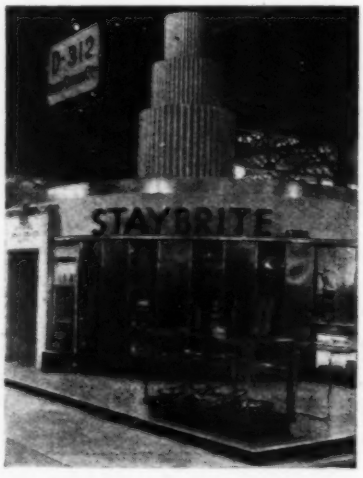
The chromium plating and anodised finishes likewise command attention. Facilities are available at the company's Birmingham works for producing spinnings up to 5ft. 6in. in diameter, which is an outsize so far as the aircraft trade is concerned.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17 (Cb.220).—"Metrovic" designers were lately called upon to develop an r.p.m. indicator for G.W.R. express locomotives. Vibration presented some stiff problems, but an effective indicator was evolved and may form the basis for similar applications to aircraft.

More prosaic are the 2½in. moving-coil ammeters and voltmeters supplied in quantity to the Air Ministry. Several items in the array of industrial electrical gear have aeronautical potentialities, as has their welding equipment.

Moseley, David, and Sons, Ltd., Ardwick, Manchester (D.630).—Looking at the apparently limitless array on this stand, one is moved to wonder how our forefathers ever got along without rubber, even if life in their day was simpler and less governed by machinery.

The production of rubber hose is an industry in itself, and everything from the thinnest extruded garden hose to reinforced large-diameter fire hose is produced by David Moseley. In a different class are rubber mountings for engine-bearer feet and, again, rubber mouthpieces and speaking tubes for aircraft.



A house in shining sheet—the Firth-Vickers "Staybrite" exhibit.

Philips Industrial (Philips Lamps, Ltd.), 145, Charing Cross Road, London, W.C.2 (Cb.712).—One can learn a tremendous lot on Stand Cb.712 about the conversion of A.C. to D.C. Philips research workers have introduced a new metal-clad rectifying valve which, they emphatically maintain, is the best method of producing D.C. to date. The range of arc welding plant and electrodes embraces a welding rectifier intended for the welding of sheet metal down to 22 S.W.G.

Sir Isaac Pitman and Sons, Ltd., 12-14, Newton Street, High Holborn, London, W.C.2 (Cb.115).—Rendezvous for students, the Pitman sanctum features the justly famed series of textbooks for the which the firm is held in high esteem among all sorts and conditions of aircraft workers.

Any exaggerated idea of the importance of aeronautics in world affairs is effectively dispelled by a glance at the works devoted to other themes.

Priestman, T. J., Ltd., Birmingham (D.509).—A miser's dream of heaven—on this stand, on every side, are shining heaps of gold and silver. In truth, these metal ingots are bronzes and brasses, aluminium alloys, and bearing metals, but are no doubt as valuable in their particular duties as the precious metals which they resemble.

All types of notched bars, billets and rolling slabs are prepared to Admiralty, Air Ministry and B.S.I. specifications.

Revvo Castor Co., Ltd., Archdale Works, Blechynden Street, London, W.11 (D.331).—Since a bearded sportsman put a round tree trunk under his bulky game to help him get it back to his naturally formed air-raid shelter people have devoted a good deal of energy to developing better forms of wheels.

The Revvo people make little wheels do a lot of work in several directions (literally) and show ball-bearing examples applicable to all manner of purposes.

The Reynolds Tube Co., Ltd., Hay Hall Works, Tyseley, Birmingham (D.623 and 522).—Manufacturers with "tubular" troubles will do well to get a prescription at one of the Reynolds "clinics." The Reynolds high-strength

light-alloy extruded sections are featured prominently; their success in three years has been quite meteoric.

Quite apart from the sections, Reynolds extrude round rods, hexagon and rectangular bars. Production facilities have been extended, so that the company is now able to offer sections which can be inscribed in a circle a foot across and weighing up to 580 lb. apiece—which is extruding extraordinary.

*Rotax, Ltd., Willesden Junction, London, N.W.*10 (Cb.501).—As one contemplates the vast array of lamps, electric horns, spot-lights, etc., displayed on the Lucas-Rotax stand and, perhaps, moves the lever controlling a Harley retractable landing light, the enormous size of catalogue which must be required to contain a list of all the firm's products is a consideration which passes through the mind.

Among aircraft magnetos, starters, generators and the like is a 24-volt motor of the remote-drive type which, though turning at 6,250 r.p.m. itself, when suitably reduced in speed through a 625 to 1 gear, efficiently operates cooling gills for radial engines, or undercarriage legs, and even gun turrets.

Rubery, Owen and Co., Ltd., Darlaston, South Staffs (D.703 and 602).—Systematic storage of materials and parts is reduced to utter simplicity by the equipment developed by Rubery, Owen. The finer points of storage have been studied first-hand, for the manufacturers of the severely smart bins, cupboards, lockers, benches and racks are also producers of pulleys, bolts and nuts and, into the bargain, produce drawn steel and general structural steelwork.

Salter, Geo., and Co., Ltd., West Bromwich, Birmingham (A.407, 306).—No matter what season it is, we may be sure that Salter's will be able to put spring into an industry.

The housewife's burden is lightened by the use of Salter's ironmongery, and, no doubt, her cakes are lighter for the accurate weighing of ingredients on a Salter's balance.

Likewise, few British aeroplanes leave the ground without a Salter spring or washer in engine or airframe. The visitor may like to ask the Salter people the total number of foot-pounds of energy represented by their exhibit, but they would rather tell him, with some just pride, of the number of air records in which their springs have figured.

*Siebe, Gorman and Co., Ltd., Westminster Bridge Road, London, S.E.*1 (D.624).—A few factors on which the Siebe, Gorman theme ("everything for safety everywhere") is based are Proto, Salvus, Fireox and Meco-Briggs oxygen-breathing apparatus; Spirelmo smoke helmets; Novita and Novox resuscitating equipment; and Puretha gas masks.

The ingenuity of the nomenclature is rivalled only by the resourcefulness exhibited in the design of this æsthetically repulsive, but practically designed, rescue gear.

*Silvertown Lubricants, Ltd., West Silvertown London, E.*16 (D.310).—Every drop of oil used overseas by the Air Ministry is supplied, it is claimed, by Silvertown, and also one-third of the consumption at home.

To specification D.T.D. 109, Speedolene aero engine oil exceeds by a wide margin the Air Ministry requirements. Orders for aero engine lubricants are not measured in gallons but in thousands of tons.

Besides the aircraft oils for the R.A.F., the Esthonian Government, and other big consumers, all oil supplied to the Admiralty is refined by Silvertown.

Home of tubing and special sections—Accles and Pollock, Ltd.

*Simmonds Aerocessories, Ltd., Strand, London, W.C.*2 (D.421).—Fifty million Frenchmen, we know, can't be wrong, and it appears highly unlikely that our own Air Ministry, Admiralty and War Office, eighteen foreign governments, and the chief foreign and British railways would make any mistake about the value of Simmonds Elastic Stop-nuts, which they use in large quantities.

These vital accessories are just as well appreciated in the aircraft industry, in which, also, other Simmonds products (e.g., remote controls and cowling clips) are widely used.

The Stanley Engineering Co., Ltd., 17, The Avenue, Egham, Surrey (D.725).—Thirty-four pounds of *Cambria's* and *Caledonia's* 35,000 "all-up" is accounted for by a little Stanley petrol engine for W/T. and battery charging. Such units are also specified for the ordinary Empire boats, the Albatross, the Atalantas and the Ensigns.

In the Empire boats the engine is installed on duralumin channels in a stainless steel casing. The specification features screened ignition.

Tecalemit, Ltd., Great West Road, Brentford, Mddx (D.415 and 316).—Though the Tecalemit exhibit is not representative of the firm's aircraft activities the occupants of the stand are well able to give information on the lubrication of valve rockers and guides, inaccessible bearings on airframes, supercharger bearings and so forth. An admirable catalogue sets out details of the various nipple systems, fuel pumps, oil cleaners and oil servicing equipment.

Thomas, Bertram, Hulme, Manchester (Cb.321).—It seemed likely that with so many types and sizes of racks, trays, shelving and steel-legged benches Bertram Thomas would be able to satisfy all comers. However, even though many well-known names—Rolls-Royce, Avro, Imperial Airways, Airspeed—appear among satisfied customers room has been found for a new version of rack with lid and shovel, known as the hopper tray. It can be filled instantaneously with, say, bolts or nuts, emptied nearly as fast with a shovel or lightened one piece at a time. Additional neatness and a covering from dust are incorporated in the improved design.

Terry, Herbert and Sons, Ltd., Redditch (B.424).—Here we find springs for every conceivable purpose from closing engine valves to expanding human muscles, but of exceptional interest is the Terry Anglepoise adjustable lamp, which, used in drawing offices, machine shops, and so forth, reduces eye-strain by casting a more intelligent light on the subject. The lamp "stays put" in any position, regardless of vibration, and the concentration made possible by the universal movement renders a 25-watt lamp as useful as a 60-watt one.

*Titanine, Ltd., Sheaveshill Avenue, Colindale, London, N.W.*9 (Cb.208).—Anyone who has come to regard Titanine solely as suppliers of aircraft dope is in for an illuminating jolt at Cb.208, where the application of cellulose and synthetic lacquers and enamels (air drying and stoving) on metal, wood, fabric, leather, paper *and* rubber is exemplified.

The latest Titanine offering to the aircraft industry is a barium chromate jointing compound (to an A.M. specification) for use when dissimilar metals are joined. Results with aluminium, anodically-treated duralumin and Elektron are illustrated.

*Vacuum Oil Co., Ltd., Caxton House, London, S.W.*1 (D.419).—Film strength, cooling capacity, tenacity and endurance are the most desirable attributes of a cutting oil, according to the Vacuum technicians whose persistency has made it possible to maintain the output of work, to preserve the tool edge, and to eliminate waste, all of which make for economy. Such achievements by the Vacuum organisation are tastefully publicised on D.419. Vacuum cutting oils are favoured by Gloster, Napier and Pobjoy.

The Valor Co., Ltd., Bromford, Erdington, Birmingham (B.401).—Frigid of foot and light of stomach, he whose duties keep him upon windy aerodromes may base his dreams on Valor heaters, boilers, cookers and ovens. In his more desperate moments he may secretly long for an opportunity to wield a Valor Foamera fire extinguisher, though this two-gallon protector would most likely deal too summarily for his liking with a conflagration of petrol, alcohol, turpentine, oil, tar or any kindred substance which reacts less thankfully than the human frame to the flame that cheers.

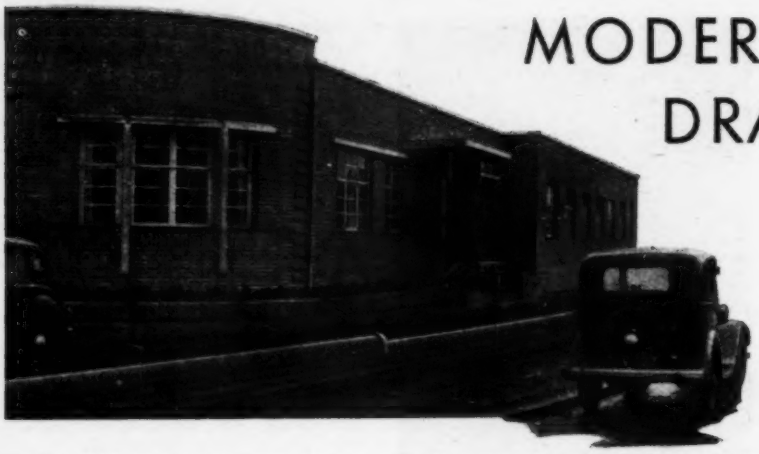
Steel storage equipment is also featured.

Incidentally, the Valor Co. have contracted for the whole of the fire-extinguisher equipment of the Birmingham B.I.F., which is no mean responsibility.

*Wakefield, C. C., and Co., Ltd., Cheapside, London, E.C.*2 (Cb.301).—Wakefield oils figure in so many flying, motoring and boating events in a year (as may be seen from their book of collected achievements) that it might be supposed that their makers would have no time for other activities; however, exhibits bear witness to the fact that no bearing, no matter what its design or how inaccessible its position, need go ungreased.

Zinc Alloy Rust-proofing Co., Ltd., Wolverhampton (B.714).—There is practically no limit to the applications of the Sherardising rust-proofing process, and specimens of metalwork treated and exposed to the elements bear witness to its impregnability.

Visitors to the B.I.F. last year may remember small metallic samples in packets, complete with nail and directions. *Flight's* sample, examined less than a week ago, had become well rusted at one end, but was quite unblemished on the treated portion.



MODERN DRAWING OFFICE

Major Halford's New Gipsy Engine Design Office at Stag Lane : Staff of Seventy

FEW who meet Major Frank Halford will realise that the youthful designer has been producing aero engines for twenty-two years or so. Not until one begins to discuss the old flying days does one remember that in 1912 or thereabout there was an assistant instructor at the Bristol flying school at Brooklands of that name. Engines were always Halford's great passion, and by 1916 he had become the "H" in the B.H.P. engine, the other two initials representing Beardmore and Pullinger respectively. The B.H.P. developed into the Siddeley Puma, which was an excellent engine for its time.

In 1923 Major Halford started as an independent engine designer, with Mr. J. L. P. Brodie as his "staff." Mr. Brodie has been Major Halford's second-in-command ever since. The first task was to design the Airdisco engine to use as many parts as possible of the old Renault engine. Then followed the Cirrus and Nimbus engines, and afterwards the Gipsy family, Series I, II, III, Major, Six and Twelve. In addition to the Gipsies, of which nearly 6,000 have been built, Major Halford has designed for the Napier company the Rapier, Dagger and Sabre series, all "H"-type engines.

For eight years, from 1929 to 1937, Major Halford had his design office in Golden Square. The volume of work increased to such an extent that it became desirable to bring the design offices and works closer together, and the new offices at Stag Lane were taken into use a few months ago.

The new office building is a red-brick structure of modern appearance, and the offices are planned on modern lines, with the general design office centrally placed in the building and surrounded by the ancillary sections, such as tracing office, blue-print department, and stress department. Below the drawing office is a fireproof and floodproof basement in which the more valuable master dawings are stored.

The drawing office has been carefully lighted and soundproofed, and each draughtsman keeps his equipment in a mobile trolley, so that if he is moved to another part of the room he just takes his trolley with him. Terry anglepoise lights are supplied with current from points in the floor, so that there are no unsightly wires. The soundproofing is so effective that a conversation is barely heard a few feet away.

"Flight" photograph

Major Frank B. Halford (right), the designer of the De Havilland Gipsy and Napier "H"-type engines, in his new office at Stag Lane with Mr. Brodie, his second-in-command.

"Flight" photographs

The new drawing office (left) has scientific lighting and sound-proofing. In surrounding offices are the tracers, blue-printing and the stress department (above).

4, 1938.

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photograph

Gipsy and
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photograph

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tracers,
(above).